HB2025 - the 71st ICFA Advanced Beam Dynamics workshop on High-Intensity and High-Brightness Hadron Beams

Report of Contributions

Contribution ID: **1** Contribution code: **THPT65**   Type: **Poster Presentation**

The study of the energy spread measurement at linac of CSNS

Thursday, October 23, 2025 5:10 PM (20 minutes)

In accelerator-based spallation neutron sources, which include a rapid cycling synchrotron (RCS), the energy spread at the end of the linac is a crucial parameter that significantly impacts the operational efficiency of the downstream RCS ring. However, in recent years, the energy spread at the linac of the Chinese Spallation Neutron Source has been inadequately measured due to limited methods for longitudinal phase space measurement. This paper presents a study on measuring the energy spread using wall current monitors at the linac. The results indicate that the energy spread is at the 10^{-3} level, consistent with simulations. Nevertheless, the uncertainty remains relatively high, necessitating further efforts to improve measurement accuracy in the future.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: HAN, Yanliang (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **2** Contribution code: **TUICC02**　　　　Type: **Invited Oral Presentation**

High intensity beam commissioning and operation of the CSNS RCS

Tuesday, October 21, 2025 2:00 PM (30 minutes)

For the China Spallation Neutron Source (CSNS), the rapid cycling synchrotron (RCS) accumulates and accelerates the injection beam to the design energy of 1.6 GeV and then extracts the high energy beam to the target. The CSNS design beam power is 100 kW, with the capability to upgrade to 500 kW. By February 2020, the beam power had reached 100 kW, and through improvements, the beam power was increased to 170 kW. During the beam commissioning process, the beam loss caused by space charge effects was the most significant factor limiting the increase in beam power. Additionally, unexpected collective effects were observed, including coherent oscillations, when the beam power higher than 50 kW. Through a series of improvements, the space charge effects and collective instabilities causing beam loss were effectively controlled. In this paper, the key issues and intense beam effects during the beam commissioning and operation of the CSNS RCS will be studied in detail and their solutions and suppression methods will be given.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: HUANG, Ming-Yang (Institute of High Energy Physics)

Session Classification: TUICC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **3** Contribution code: **WEICB01**   Type: **Invited Oral Presentation**

Update design for the Muon Collider Proton Complex

Wednesday, October 22, 2025 2:00 PM (30 minutes)

The proton complex is the first piece in the Muon Collider, it comprises a high power acceleration section, a compressor and a target delivery system. For the International Muon Collider Collaboration (IMCC) we are investigating two possibilities: a 5 GeV (2 MW) and a 10 GeV (4 MW) final energies. In this work we present the updated design for the proton complex, including chopping schemes for the linac, an investigation on the use of an RCS for reaching the final energy and a refinement of the simulations for the accumulator and compressor sessions.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: JOHANNESSON, Sofia (École Polytechnique Fédérale de Lausanne)

Session Classification: WEICB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: 4 Contribution code: **WECCC03**   Type: **Contributed Oral Presentation**

Beam dynamics and Linac design for the 200 MeV energy upgrade at KOMAC

Wednesday, October 22, 2025 2:50 PM (20 minutes)

Since 2013, the Korea Multi-purpose Accelerator Complex (KOMAC) has been operating a 100 MeV linear proton accelerator. Designed from its inception with the long-term vision of upgrading to a high-power spallation neutron source, KOMAC's proton accelerator aims to achieve a final energy of 1 GeV. As an intermediate milestone toward this goal, a 200 MeV energy upgrade is currently being planned.

To support this upgrade to 200 MeV, comprehensive linac designs and beam dynamics simulations have been carried out, adopting a Separate-type Drift Tube Linac (SDTL). This presentation discusses the beam dynamics design of the linac and the user-side beamline for the proposed upgrade. Additionally, error analysis simulations were performed based on the initial design calculations. These simulations have validated the robustness and stability of the linac design, confirming its feasibility for stable operation at 200 MeV linac.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: MOON, Seok Ho (Korea Multi-purpose Accelerator Complex)

Session Classification: WECCC WGB contributed oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **5** Contribution code: **WEICB04**   Type: **Invited Oral Presentation**

Impedance of ceramic chambers and its impact on beam stability

Wednesday, October 22, 2025 3:30 PM (30 minutes)

The China Spallation Neutron Source (CSNS) utilizes ceramic vacuum chambers in the high-dynamic-field regions of the Rapid Cycling Synchrotron (RCS) to preserve the vacuum environment of beam. Previous theoretical studies suggested that the impedance of this structure could be neglected concerning its impact on the beam. Recent measurements, however, have detected low-frequency resonant impedance in a ceramic vacuum chamber within the RCS, which further investigations have confirmed as the source of transverse coupled-bunch instability in the RCS. This report details the determination of ceramic chamber impedance and its contribution to transverse coupled-bunch instability, as well as the impedance reduction technologies developed to meet the high-power requirements of the RCS.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: HUANG, Liangsheng (Institute of High Energy Physics)

Session Classification: WEICB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **6** Contribution code: **THCBC02**   Type: **Contributed Oral Presentation**

Low-frequency transverse resonator impedances on the ISIS proton synchrotron

Thursday, October 23, 2025 11:50 AM (20 minutes)

ISIS is the pulsed, spallation neutron and muon source at the Rutherford Appleton Laboratory in the UK. Its rapid cycling synchrotron accelerates 3e13 protons-per-pulse from 70 to 800 MeV at 50 Hz, delivering a mean beam power of 0.2 MW to its two target stations. The intensity of ISIS is beam-loss limited, so increasing its neutron and muon output requires beam-loss mechanisms to be well understood and alleviated.

Despite mitigation efforts, a vertical head-tail instability is often one of the main sources of beam-loss during high-intensity operations at ISIS. Finite-element simulations and probe-coil measurements have identified a series of low-frequency resonator impedances from the RF screens in the AC magnets. New bench measurements of RF screens will be presented that provide further evidence of them being responsible for the beam instability, and have been used to inform an update to the impedance model. A comparison between this model and beam-based impedance measurements will be presented, as well as analytical predictions for beam stability at ISIS. A possible method to mitigate the RF screen resonator impedances will also be introduced.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: POSTHUMA DE BOER, David (Science and Technology Facilities Council)

Session Classification: THCBC WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **7** Contribution code: **THPT68**   Type: **Poster Presentation**

Transverse 4D phase space reconstruction using wire scanner measurements at the CSNS Linac

Thursday, October 23, 2025 5:10 PM (20 minutes)

The characterization of particle distribution in phase space and its evolution along the beamline is fundamental for accelerator beam commissioning and analysis. While numerical simulations enable straightforward tracking in phase space, experimental reconstruction of phase space distributions remains challenging, particularly for hadron beams where space-charge effects are unavoidable. This paper presents a method to reconstruct the transverse 4D phase space using a particle tracking code and beam profile data from multiple wire scanners. By integrating numerical modeling with experimental measurements at the China Spallation Neutron Source (CSNS) linac, detailed discussions on the reconstruction process and the results for beam dynamics optimization are presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LIU, Xingguang (Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **8** Contribution code: **THPT56**   Type: **Poster Presentation**

RF-Track for beam dynamics studies in high-intensity hadron linacs

Thursday, October 23, 2025 3:30 PM (20 minutes)

High-intensity hadron accelerators demand precise modeling of collective effects to ensure beam quality preservation and beam loss mitigation. RF-Track is a versatile, computationally efficient 6D particle tracking code developed to simulate the dynamics of beams under the influence of space charge, wakefields, and scattering effects in complex accelerator layouts, including RFQs, LEBT and MEBT lines. Recent developments have focused on adapting RF-Track for the challenges posed by high-intensity hadron machines. A key advancement is the implementation of intra-beam scattering (IBS), enabling detailed studies of emittance growth and beam halo formation across various beam energies and lattice configurations. The addition of IBS complement the existing space charge and wakefield models, allowing RF-Track to provide accurate and physically comprehensive start-to-end simulations. This contribution will highlight the recent developments, showcase applications to representative hadron beamlines, and discuss the roadmap for RF-Track as a tool for high-brightness hadron beam studies.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: LATINA, Andrea (European Organization for Nuclear Research)

Presenter: LATINA, Andrea (European Organization for Nuclear Research)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **9** Contribution code: **THFA11**   Type: **Flash Poster Presentation**

Development of a beam commissiong tool based on Bayesian optimization in CSNS

Thursday, October 23, 2025 2:55 PM (5 minutes)

This study explores the use of Bayesian optimization in reducing CSNS RCS beam loss. Bayesian optimization is a global optimization framework ideal for complex, black-box functions. By building a probabilistic model of the objective function, often a Gaussian process, it selects new sampling points based on predicted uncertainty, efficiently finding the optimum with limited resources. It has proven more effective than grid and random searches in hyperparameter tuning and has been successfully applied in fields like laser processing and materials design. In RCS beam loss optimization, its versatility allows for the selection of various key beam physics quantities to construct suitable target functions, effectively cutting beam loss and boosting accelerator efficiency. Experimental results show it can swiftly converge to optimal solutions with minimal computational resources, highlighting its adaptability and scalability. This research offers new insights into accelerator beam optimization and underscores the broad application potential of Bayesian optimization in complex system optimization.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LIU, Hanyang (Institute of High Energy Physics)

Session Classification: THFA WGs flash talks

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **10** Contribution code: **TUCDB04**   Type: **Contributed Oral Presentation**

Research and development of the timing system for CSNS-II accelerator

Tuesday, October 21, 2025 5:30 PM (20 minutes)

The China Spallation Neutron Source (CSNS) successfully achieved its design power level of 170 kW in 2025. The CSNS-II project aims to increase the beam power to 500 kW by enhancing the linac energy to 300 MeV. To ensure coordinated operation across all accelerator subsystems amidst increasing complexity and precision requirements, the timing system has been redesigned with an event-driven architecture to meet the stringent synchronization demands of the upgraded facility. A new generation of domestically developed generic control and data acquisition AMC modules has been introduced to fulfill the timing system requirements of CSNS-II. These modules comply with the MicroTCA.4 standard and are built around the Xilinx Zynq UltraScale+ MPSoC, capable of running EPICS IOC applications and responsible for generating and distributing synchronized clock signals and trigger events throughout the facility, providing a common time base for time-correlated data acquisition. This article provides a comprehensive overview of the timing system, detailing the master-slave architecture, a method for precise clock and trigger synchronization, and prototype test results of the CSNS-II accelerator.

Footnotes

Funding Agency

Funding was provided by the Guangdong Basic and Applied Basic Research Foundation (2021B1515120021)

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZHU, peng (Institute of High Energy Physics)

Session Classification: TUCDB WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **11** Contribution code: **THPT67**   Type: **Poster Presentation**

Time-resolved space charge compensation studies at the high-intensity KOMAC beam test stand

Thursday, October 23, 2025 5:10 PM (20 minutes)

High-intensity ion beams are inherently subject to significant space charge effects, which lead to complex beam dynamics and emittance growth, particularly in the Low Energy Beam Transport (LEBT) region. In this study, the dynamics and optimization of space charge compensation (SCC) of a high-perveance proton beam are investigated through a combination of 3D numerical modeling and time-resolved experimental measurements in the KOMAC Beam Test Stand (BTS). The BTS is an RFQ accelerator structure that accelerates pulsed proton beams to energies of up to 1 MeV with beam currents in the range of 15–20 mA. The transient evolution of the beam's phase space under varying SCC conditions is examined using Allison scanners. Parametric studies are conducted to assess the influence of beam current, injected gas species, pressure, and initial beam size on SCC dynamics. Nonlinear space charge effects are considered, particularly those influencing SCC efficiency and transverse emittance growth. A correlation between SCC and RFQ matching conditions is also examined, demonstrating the necessity of adjusting solenoid magnet settings to maintain optimal transmission efficiency.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: COSGUN, Emre (Ulsan National Institute of Science and Technology)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **12** Contribution code: **WEICB03**   Type: **Invited Oral Presentation**

Space charge effects during half-integer resonance crossing in the CERN PSB

Wednesday, October 22, 2025 3:00 PM (30 minutes)

Space charge effects are the main performance limitation for the beam brightness in the CERN Proton Synchrotron Booster (PSB). Operating at higher vertical tunes, near or above the vertical half-integer resonance 2Qy=9, offers more space in the tune diagram to accommodate the large space charge tune spread, potentially allowing for brighter beams. In this context, an experimental campaign was performed to characterize the space charge dynamics during the controlled crossing of the half-integer resonance. This contribution summarizes the main results. The scaling of beam degradation with the space charge detuning and resonance crossing rate is analyzed, which could be relevant to any high-intensity synchrotron operating near a half-integer resonance. Finally, the achievable beam brightness in the PSB for injection above the half-integer resonance was tested experimentally and first results are reported here.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: PREBIBAJ, Tirsi (European Organization for Nuclear Research)

Session Classification: WEICB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **13** Contribution code: **WECBC01**   Type: **Contributed Oral Presentation**

A robust and redundant design of the fast protection system for CSNS-II

Wednesday, October 22, 2025 11:30 AM (20 minutes)

The Fast Protection System (FPS) is critical for ensuring the efficient and safe operation of the large-scale scientific facility at the China Spallation Neutron Source (CSNS). To address the enhanced requirements of CSNS-II, an advanced FPS architecture has been developed, leveraging high-performance field-programmable gate arrays (FPGAs), high-speed rocket IO serial communication links, and the advanced telecommunications computing architecture (ATCA) platform. The proposed hardware framework guarantees a system-wide response time of less than 8 microseconds, accounting for fiber optic transmission delays, circuit propagation times, and interlock logic processing. Compared with traditional FPS,the upgraded FPS architecture integrate critical diagnostic signals from devices such as the beam loss monitor (BLM) and the differential beam current monitor (D-BCM), improving in response time and reliability. This paper outlines the design principles, system architecture, and implementation strategy, achieving high availability, reliability, and real-time performance. The enhanced FPS is essential for maintaining operational stability with the long-term operation at higher beam powers.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZHU, peng (Institute of High Energy Physics)

Session Classification: WECBC WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **14** Contribution code: **WECDB03**   Type: **Contributed Oral Presentation**

Optimization of beam performance by correction of impedance driven tune shifts at the CERN SPS

Wednesday, October 22, 2025 5:40 PM (20 minutes)

High-intensity multi-bunch beams in the CERN Super Proton Synchrotron (SPS) experience significant coherent and incoherent tune shifts due to the transverse beam coupling impedance. Studies with LHC-type beams have been performed to optimize the working point along the extended SPS injection plateau to enhance beam performance and brightness. The initial tune correction approach focused on adjusting the coherent tunes at each injection. However, measurements showed that maintaining the incoherent tunes of the beam constant with multiple beam injections allows improving beam brightness by avoiding emittance growth due to resonances in the presence of space charge. We report here about measurements of emittance growth and beam losses for various working points and tune correction approaches in the multi-bunch scenarios. The results indicate that maintaining the incoherent tunes constant effectively mitigates emittance growth, leading to enhanced beam brightness. These findings highlight the critical role of incoherent tunes in optimizing high-brightness beams in the SPS.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: MASES, Ingrid (European Organization for Nuclear Research)

Session Classification: WECDB WGA contributed oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **15** Contribution code: **THPT17**   Type: **Poster Presentation**

Design of 6D Cooling and Final Cooling Channels for a Muon Collider

Thursday, October 23, 2025 5:10 PM (20 minutes)

The muon collider is a promising candidate for exploring new physics at the energy frontier, offering the advantages of lepton collisions at multi-TeV scales. Achieving high luminosity requires reducing the six-dimensional (6D) emittance of the muon beam by several orders of magnitude within the muons' limited lifetime. This is accomplished through ionization cooling, which involves two main stages: initial 6D cooling and final transverse cooling. This paper presents an updated lattice design for both rectilinear 6D cooling and final cooling. The latest design achieves a factor of two reduction in final transverse emittance, marking a significant advancement toward meeting the beam quality requirements of a future muon collider.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZHU, Ruihu (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **16** Contribution code: **THPT28**   Type: **Poster Presentation**

Electron cooling using longitudinal hollow electron beam

Thursday, October 23, 2025 5:10 PM (20 minutes)

The intra-beam scattering in high charge state intense heavy ion beams is a problem worth considering. By controlling the longitudinal distribution of the ion beam, it may be possible to alleviate the ion beam loss and improve the lifetime of the ion beam caused by intra-beam scattering. Unlike the traditional cooling process of direct current electron beams or longitudinal uniform distribution electron bunch beams, a longitudinal hollow electron beam is used to cool heavy ion beams. Ions at the edge of the ion beam will receive stronger cooling, while ions at the center of the ion beam will receive weaker cooling, avoiding overcooling at the center of the ion beam. This paper discusses the generation, measurement, and related issues of longitudinal hollow electron beams. Corresponding solutions and suggestions have been proposed for the problems and challenges that may be encountered in the research. The cooling process of longitudinal hollow electron beams will be simulated and experimentally studied in the future, with the hope of obtaining beneficial effects.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenters: Dr ZHAO, He (Institute of Modern Physics); YANG, Xiaodong (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **18**　　　　　　　　　　　　　　　　　Type: **not specified**

Registration

Sunday, October 19, 2025 3:30 PM (4h 30m)

Registration

Contribution ID: **19**   Type: **not specified**

Welcome Reception

Welcome Reception

Contribution ID: **20**   Type: **Invited Oral Presentation**

Welcome & Plenary Talks

Welcome & Plenary Talks

Contribution ID: **21** Contribution code: **THPT59**　　　　　Type: **Poster Presentation**

Techniques and Progress in Beam Transverse Emittance Measurement at the CSNS RCS

Thursday, October 23, 2025 5:10 PM (20 minutes)

The Rapid Cycling Synchrotron (RCS) of the China Spallation Neutron Source (CSNS) is a key part of the accelerator chain. It accelerates the 80 MeV low-energy beam from the linac to 1.6 GeV and extracts it to hit the target for neutron production. As an important optics parameter, the precise measurement of the transverse emittance is vital for understanding the space charge evolution in the RCS and enhancing the beam quality. In 2019 summer maintenance, a Residual Gas Ionization Profile Monitor (IPMs) was installed for measuring the beam profile turn by turn but failed to work due to external noise. To address this, a new approach was proposed: using a kicker to extract the beam early, with a downstream wire scanner system scanning the beam envelope to get the emittance indirectly. By implementing this method, the emittance data at 170 kW operating power were successfully obtained, and the emittance results under different beam powers were compared and analyzed. In addition, the measurement-related issues are discussed, and future optimization directions were proposed to boost measurement accuracy and RCS performance.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter:　LI, Yong (Dongguan Neutron Science Center)

Session Classification:　THPT poster session

Track Classification:　WGD:Operations and Commissioning

Contribution ID: **22**   Type: **not specified**

Break + Group Photo

Break + Group Photo

Contribution ID: **23**   Type: **not specified**

Plenary Talks

Plenary Talks

Contribution ID: **24** Type: **not specified**

Lunch Break

Lunch Break

Contribution ID: **25**　　　　　　　　　　　　　　　　Type: **not specified**

Plenary Talks

Plenary Talks

Contribution ID: **26**

Type: **not specified**

Break

Break

Contribution ID: **27**   Type: **not specified**

Seminar(s)

Seminar(s)

Contribution ID: **28** Type: **not specified**

LOC′s invitation

LOC′s invitation

Contribution ID: **29** Type: **Invited Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **30**   Type: **Invited Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **31** Type: **Contributed Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **32**

Type: **Contributed Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **33**   Type: **Invited Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **34** Type: **Contributed Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **35**   Type: **Invited Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **36** Type: **Contributed Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **37** Type: **not specified**

IOC Meeting

IOC Meeting

Contribution ID: **38** Type: **Contributed Oral Presentation**

WG parallel sessions

WG parallel sessions

Contribution ID: **39** Type: **Contributed Oral Presentation**

WG parallel sessions

Contribution ID: **40**　　　　　　　　　　　　　　　Type: **not specified**

Flash Talks

Flash Talks

Contribution ID: **41**

Type: **Poster Presentation**

Posters

Contribution ID: **42** Type: **not specified**

Banquet

Banquet

Contribution ID: **43** Type: **Contributed Oral Presentation**

WG parallel sessions

Contribution ID: 44 Type: **not specified**

WGOC/BID Summary

Contribution ID: **45**   Type: **not specified**

Closing Remarks

Closing Remarks

Contribution ID: 46 Type: **not specified**

Visit to HIAF and CiADS facilities

Contribution ID: **47** Contribution code: **THPT18**   Type: **Poster Presentation**

Design of a 2300 W 352 MHz Solid-State Amplifier Module with Integrated EtherCAT Interface for Monitoring and Control

Thursday, October 23, 2025 5:10 PM (20 minutes)

For multi-unit RF amplifier systems, a 2300 W solid-state RF power amplifier module with integrated EtherCAT and USB interface has been developed. The RF amplifier section is constructed from the latest LDMOS from Ampleon with a power of 2300 W at an efficiency of 72 % and is fully shielded and offers space for adding a driver amplifier or phase shifter circuit. The module is equipped with a DIN 7/16 output connector and an N-type input connector and is housed in a metal housing of 200 x 95 x 80 mm. The cooling of the RF LDMOS is done via a CNC milled copper cooling plate that is gold-plated. The gold layer prevents chemical oxidation with other aluminum parts such as an aluminum main plate. In a multi-unit system, the EtherCAT interface provides lightning-fast and synchronous control and monitoring of parameters such as supply voltage and current, heat sink and LDMOS temperature, forward and reverse RF power. Outside the EtherCAT environment, the USB interface can be used in combination with a Windows GUI. Eight LEDs are available as visual indicators. The entire process of design, assembly and testing takes place in the Netherlands, which guarantees quality and traceability.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: Mr LEIJENAAR, William (Leijenaar Electronics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **48** Contribution code: **THPT29**   Type: **Poster Presentation**

Experimental study on the fast bunch merging in high-intensity hadron synchrotrons

Thursday, October 23, 2025 5:10 PM (20 minutes)

For high-intensity hadron synchrotrons, the longitudinal manipulation (rf gymnastic) is of practical importance to customize the parameters and status of the hadron beams to fulfill various scientific and industrial goals. For the recently-built China Spallation Neutron Source (CSNS), a high-intensity single-bunch operation mode based on longitudinal bunch merging has been proposed to enhance the neutron resolution for a few experiments of nuclear data measurement. We present experiment study and recent progress on the fast and high-intensity bunch merging carried out in the CSNS RCS. The feasibility of the fast and high-intensity bunch merging scheme in the RCS is demonstrated. In the fast bunch merging with low intensity, basic parameters for bunch merging, such as merging time are systematically optimized. In the fast bunch merging with high intensity, to compensate the high-intensity effects, including space charge and beam loading is developed.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: YUAN, Yaoshuo (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **49** Contribution code: **THPT61**   Type: **Poster Presentation**

The experimental evaluation of third-order resonance correction using 8 Trim-S in J-PARC MR

Thursday, October 23, 2025 5:10 PM (20 minutes)

In the J-PARC Main Ring (MR), an upgrade project involving a total of 24 Trim-S units is in progress to further suppress beam loss caused by off-momentum particles. This effort targets key resonances, including the third-order resonance 3vx=64 and vx+2vy=64, and a fourth-order resonance 4vx=85, which are produced by the combination of vx=21 and 3vx=64. Four additional Trim-S units have been installed in the D3 power supply building, supplementing the original four units located in the D2 power supply building, resulting in a total of eight operational Trim-S units in J-PARC MR. To evaluate the feasibility of the full 24-unit upgrade, step-by-step experimental studies were carried out using first the individual sets of four Trim-S units in D2 and D3, and subsequently all eight units combined, for resonance correction. This paper reports the experimental procedures, analyzes the results, and outlines the plans for the next step based on the experimental findings.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: TAN, Yulian (High Energy Accelerator Research Organization)

Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **50** Contribution code: **THPT55**   Type: **Poster Presentation**

Resonant Impedance simulation of RF shields on ceramic chambers

Thursday, October 23, 2025 5:10 PM (20 minutes)

The transverse coupled-bunch instability (TCBI) has been observed in the rapid cycling synchrotron (RCS) of the China Spallation Neutron Source. Subsequent measurements indicated that the RF shield of the ceramic chambers exhibits a resonant impedance in the low-frequency range, preliminarily suggesting it is responsible for the instability. The RF shield has been carefully simulated to further confirm the source and explore the characteristics of the resonance. The results show that the impedance depends on the material of the RF shield, and the capacitance, inductance, and resistance of the lumped electronic components. In conclusion, the resonant impedance of the RF shield is identified as the source of the TCBI in the RCS. Furthermore, optimization of the impedance can potentially achieve high beam power in the RCS.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **51** Contribution code: **WEIAB03**   Type: **Invited Oral Presentation**

Operation status and recent upgrade of the HIRFL facility

Wednesday, October 22, 2025 9:30 AM (30 minutes)

The Heavy Ion Research Facility at Lanzhou (HIRFL) is a significant infrastructure for nuclear physics, atomic physics and application sciences in China. It consists of linac injector, cyclotrons, synchrotrons and several experimental terminals. Heavy ion beams up to uranium can be accumulated, accelerated and delivered to different terminals. Recently, a CW linac was installed as the injector of the cyclotron SSC to increase beam intensities. An upgrade of synchrotrons including dipole power supply, vacuum system, kicker power supplies and septum was completed to ensure the maximum operation magnetic rigidity of 12 Tm. In this paper, the HIRFL operation status was introduced and details of upgrade projects were presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WEIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **52** Contribution code: **TUICC04**　　　　　Type: **Invited Oral Presentation**

Current status and upgrade plans of the KOMAC proton accelerator

Tuesday, October 21, 2025 3:00 PM (30 minutes)

The Korea Multipurpose Accelerator Complex (KOMAC) has been operating a 100 MeV Proton Linear Accelerator (Linac) since 2013, supporting various research and industrial applications by providing proton beams to users through four regularly used beam lines. In addition to these, a neutron beam line has completed pilot operations and is set to begin user services. In parallel, maintenance and replacement of aging equipment, including Radio Frequency Quadrupole and Drift Tubes, are underway. To enhance beam diagnostic techniques, we conducted beam physics studies using a Beam Test Stand for beam phase space distribution measurements and space charge compensation.

An energy upgrade of the proton linear accelerator is also planned. The proposed upgrade of the 100 MeV proton lianc consists of the 200 MeV linac section, two beam lines and target rooms, building expansion, and utility upgrade.

This paper discusses our recent progress and the upgrade plans for the KOMAC linac.

Footnotes

Funding Agency

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Yes

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Session Classification: TUICC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **53** Contribution code: **WEIAC01**   Type: **Invited Oral Presentation**

RFSoC based Transverse Feedback Processor for J-PARC Proton Synchrotrons

Wednesday, October 22, 2025 8:30 AM (30 minutes)

Transverse feedback suppresses beam instabilities that are prominent in high-intensity beams and is essential for their stable acceleration. At J-PARC, a digital signal processor is being developed for the transverse feedback systems in the Main Ring and RCS proton synchrotrons. The processor uses an RFSoC, an FPGA with integrated ADCs and DACs. It segments 100-ns-long bunches at a sampling rate of 576 MS/s and applies piecewise feedback control to each segment.

The processor performs the following functions:

1) BPM signals with differential response are offset-corrected and integrated to detect the position of each segment. 2) FIR filtering compensates for changes in the revolution period during acceleration. 3) Feedback kick timing is varied to match beam passage timing at the kicker, which changes with the revolution period. This presentation describes the processor architecture and reports results from bench tests.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: NAKAMURA, Takeshi (High Energy Accelerator Research Organization)

Session Classification: WEIAC WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **54** Contribution code: **THPT25**   Type: **Poster Presentation**

Dynamic Aperture Tracking for High-Intensity Proton Accelerators

Thursday, October 23, 2025 4:10 PM (20 minutes)

Dynamic aperture tracking is an widely employed and effective method in the design of circular accelerators. However, in high-intensity proton accelerators, the pronounced space charge effect induces substantial tune shifts, which can severely compromise the accuracy of nonlinear dynamics analysis. In this study, we present a novel dynamic aperture tracking code tailored for high-intensity proton accelerators, which explicitly accounts for space charge-induced tune shifts. The CSNS/RCS synchrotron serves as a case study to validate the code's efficacy.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **55** Contribution code: **THPT69**   Type: **Poster Presentation**

Tune Optimization for CSNS-II RCS: Simulations and Machine Studies

Thursday, October 23, 2025 5:10 PM (20 minutes)

Based on the beam commissioning of CSNS-I RCS, the current tune above the half-integer resonance exhibits extremely narrow parameter margins and severe instabilities. Therefore, to further increase the beam power in Phase II, significant optimization of the tune is required.

First, we conducted a series of simulations. A total of 97 tunes were selected on the resonance diagram, and the beam transmission efficiency was simulated, taking into account space charge effects and instabilities. The results demonstrate that the tunes below the half-integer resonance (near 4.3/5.3) are instability-free and can achieve transmission efficiencies exceeding 99% (up to 140 kW in Phase I and 700 kW in Phase II).

Subsequently, to verify stable operation at the tunes near 4.3/5.3 in the actual machine, we performed a series of machine studies. The results confirm that these tunes remain instability-free and can achieve stable beam supply at 140 kW (corresponding to 700 kW in Phase II under equivalent space charge tune shift conditions). This provides strong evidence that the selected tunes can support stable 700 kW beam operation during Phase II commissioning.

Footnotes

Funding Agency

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Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **56** Contribution code: **TUCDB01**   Type: **Contributed Oral Presentation**

The ANTHEM project: design and construction of a RFQ driven neutron source for BNCT

Tuesday, October 21, 2025 4:30 PM (20 minutes)

The project Anthem, funded within the Next Generation EU initiatives, includes the realization of an accelerator based BNCT (Boron Neutron Capture Therapy) facility at Caserta, Italy.
The INFN (LNL, Pavia, Napoli, Torino) has in charge the design and construction of the epithermal neutron source, that will assure a flux of 10^9 n/(s cm2) with characteristics suited for deep tumors treatment. The proton accelerator for ANTHEM BNCT project is based on a single accelerator stage which is a CW Radio Frequency Quadrupole (RFQ), able to produce proton beam of 30 mA at 5 MeV.
The protons will collide to a berillium target to produce neutrons. The target is designed following a three-layered concept.
The transport line (MEBT) between RFQ and target has been optimized to guarantee uniform foothprint of the beam on the target and mek possible the dissipation of 1kW/cmˆ2 power desnity.
In the paper an overview of the scientific challanges and the project status will be given.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: TUCDB WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **57** Contribution code: **TUCDB02**   Type: **Contributed Oral Presentation**

Alternative design for the IFMIF-DONES superconducting half-wave resonators

Tuesday, October 21, 2025 4:50 PM (20 minutes)

The IFMIF-DONES facility will irradiate and characterize materials to be used in fusion reactors using a neutron flux produced by the interaction of a deuteron beam with a liquid lithium target. A superconducting radiofrequency linear accelerator will bring the deuteron beam to the final energy of 40 MeV through a series of superconducting half-wave resonators operating at 175 MHz. A prototype cavity for the final acceleration stage (optimized for $\beta = 0.18$) was designed, fabricated and tested at CEA. Taking this prototype as a starting point, an alternative design of the internal geometry of the cavity was developed at LNL to optimize it from the point of view of production, while maintaining its performance as close as possible to what was observed at CEA. This contribution describes the results achieved in the simulation campaign that led to the definition of this alternative design, the evaluation of its electromagnetic properties and the study of multipacting effects.

Footnotes

Funding Agency

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Presenter: D'ANDREA, Marco (Istituto Nazionale di Fisica Nucleare)

Session Classification: TUCDB WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **58** Contribution code: **THPT32**   Type: **Poster Presentation**

H⁻ Beam Halo Collimation using Stripping and Applications of the Secondary Proton Beam

Thursday, October 23, 2025 5:10 PM (20 minutes)

To mitigate beam loss during RCS injection and in the transport line from the linac to the ring, a novel transverse beam halo collimation system was developed for the CSNS LRBT beamline. The system employs three sets of stripping foils arranged with a 60° phase shift, using twelve carbon foils to convert peripheral H⁻ ions with beam power below 2 kW into protons. Experimental results demonstrate that the collimators effectively reduce injection beam loss and contribute to RCS beam power enhancement. Moreover, the resulting proton beams enable medium-energy proton irradiation experiments and isotope production, thus achieving dual objectives of beam loss control and secondary beam utilization. This work demonstrates an effective approach for beam halo management in high-power proton accelerators.

Footnotes

Funding Agency

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Yes

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Presenter: LI, Zhiping (Dongguan Neutron Science Center)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: 59 Contribution code: **THPT10**   Type: **Poster Presentation**

Beyond 1 MW Operation of the J-PARC RCS with Minimum Beam Loss

Thursday, October 23, 2025 5:10 PM (20 minutes)

In the 3-GeV RCS of J-PARC, we have already achieved user operation at the designed 1 MW beam power. The beam loss and the corresponding machine activation have been sufficiently minimized to obtain a stable operation. To cope with user demands, the beam power of the RCS has to be increased far beyond the designed 1 MW. For that purpose, we have performed numerical simulation and beam studies for 1.5 MW beam power by increasing both peak current and injection pulse length of the linac beam injected into the RCS. We have demonstrated an extremely low beam loss rate of ~1E-4 corresponding to a loss power of even less than 0.1 kW against the collimator capacity of 4 kW. The beam loss occurs only at the injection energy localizing well at the collimator section. Recent beam test and simulation results at 1.5 MW beam power are presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: SAHA, Pranab (Japan Proton Accelerator Research Complex)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **60** Contribution code: **WECBC03**   Type: **Contributed Oral Presentation**

Surrogate Modeling of Beam Dynamics with Physics Constraints and Uncertainty Quantification

Wednesday, October 22, 2025 12:10 PM (20 minutes)

Fast and precise beam dynamics simulations are essential for particle accelerator design and optimization. Machine learning enables fast end-to-end surrogate models, but these often fail in beamline parameter optimization. We propose a physics-constrained temporal convolutional network (TCN) to predict Twiss parameters along the beamline. The model achieves high-precision 6D to 350×6D mapping, with physics constraints improving accuracy. Our method includes uncertainty quantification, enabling better parameter space exploration and weighted optimization. In beam envelope optimization, only six design points were needed for satisfactory results. This approach provides a high-fidelity surrogate model for accelerator beam dynamics.

Footnotes

Funding Agency

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Yes

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Session Classification: WECBC WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **61** Contribution code: **TUIBC01**   Type: **Invited Oral Presentation**

A Novel Linac Simulation Code AVAS

Tuesday, October 21, 2025 11:00 AM (30 minutes)

Advanced Virtual Accelerator Software is a high-performance simulation tool for modeling beam transport processes in high-intensity linear accelerators. AVAS has multiple functions, including multi-particle tracking, engineering analysis, multi-beam transport, and preset accelerator operational parameters. Algorithmically, the Particle-in-Cell algorithm has been modified based on symmetry principles, accelerating space charge field calculations by a factor of four while maintaining simulation accuracy. In addition, AVAS uses a combined particle motion mode that adaptively switches between time and position as independent variables based on element type, effectively balancing numerical simulation accuracy and computational speed. Performance-wise, AVAS has developed an ultra-high-speed GPU version achieving three orders of magnitude speed enhancement in large-scale multi-particle simulations. Furthermore, a cloud computing simulation platform has been deployed on the computing cluster. This platform features an intuitive graphical user interface and efficient data post-processing capabilities, significantly improving computational performance and user experience.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: TUIBC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **62** Contribution code: **WECDB02**   Type: **Contributed Oral Presentation**

Simulations of beam-coupling impedance to guide model-based mitigations in Hadron Rings

Wednesday, October 22, 2025 5:20 PM (20 minutes)

Beam coupling impedance is a fundamental performance limitation in high-intensity hadron rings, affecting both beam stability and the thermal load on accelerator components. As beam intensity increases, impedance-driven collective effects—such as transverse mode coupling and longitudinal coupled-bunch instabilities—become more pronounced, while beam-induced power losses can cause local overheating and potential hardware damage. Accurately evaluating these effects remains a major challenge due to the complex geometries of the accelerator devices, the correct modelling of electromagnetic material properties, and the ranges of frequencies that need to be covered. Accurate impedance modelling is essential for predicting instability thresholds and quantifying power deposition in both of current and future hadron accelerators, such as the LHC and FCC-hh. In this contribution we will show how the development of modern open-source Wakefield solvers like Wakis allow addressing the current computational challenges in beam-coupling impedance modelling. Moreover, examples will be discussed, in which the design of existing devices is modified to optimise their impedances.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WECDB WGA contributed oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **63** Contribution code: **THFA08**   Type: **Flash Poster Presentation**

Controlling induced radioactivity in CSNS RCS

Thursday, October 23, 2025 2:55 PM (5 minutes)

Controlling induced radioactivity remains crucial for high-intensity proton accelerators. This study analyzes radiation hotspots in a Rapid Cycling Synchrotron (RCS) using extensive dose measurements (2018-2025). We identified hotspots (>5 mSv/h) exhibiting either transient ("peaking-then-decreasing") or persistent ("increasing-then-stabilizing") behavior. Strategic measures - orbit correction, parameter optimization, and hardware improvements - effectively reduced radiation, exemplified by Kicker01's dose rate dropping from 20 mSv/h. However, persistent hotspots like R1SD03 (~10 mSv/h) require further study of local beam loss mechanisms. These findings advance radiation control strategies for safer, more efficient proton accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: AN, Yuwen (Institute of High Energy Physics)

Session Classification: THFA WGs flash talks

Track Classification: WGD:Operations and Commissioning

Contribution ID: **64** Contribution code: **THPT66**   Type: **Poster Presentation**

Third-order resonances and the correction in J-PARC MR

Thursday, October 23, 2025 5:10 PM (20 minutes)

Beam loss reduction is essential to achieve higher beam intensity in the main ring synchrotron (MR) of the Japan Proton Accelerator Research Complex (J-PARC). We have observed the effect of the third order non-structure resonances of 3vx=64 and vx+2vy=64. The resonance driving terms were measured with the current settings of the trim coils of the sextupole magnets. Both resonances have been corrected with four sets of the trim coil systems. Consequently, the beam loss was significantly reduced. Further correction of the resonances is planned to include the effect of off-momentum particles for the beam intensity upgrade. For that purpose, we have searched for sextupole error fields as causes of the resonances. An effective procedure for the search was devised using measurements of the nonlinear dispersion function. Because the sextupole field contributes to the first order nonlinear dispersion function, the distribution of the sextupole fields can be derived from the distribution of the nonlinear dispersion function measured using the beam position monitors.

Footnotes

Funding Agency

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Presenter: IGARASHI, Susumu (High Energy Accelerator Research Organization)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **65** Contribution code: **THIAB02**   Type: **Invited Oral Presentation**

Progress of High-Duty Deuteron Beam Commissioning in LIPAc

Thursday, October 23, 2025 9:00 AM (20 minutes)

The Engineering Validation and Engineering Design Activities for the International Fusion Materials Irradiation Facility (IFMIF/EVEDA) are being conducted under the Broader Approach agreement between EURATOM and the Japanese government. The Linear IFMIF Prototype Accelerator (LIPAc) aims at validating the design of the low-energy section of the 40-MeV/125-mA IFMIF deuteron accelerator, thus up to 9 MeV in continuous-wave (CW) operation. While the Superconducting RF Linac (SRF Linac) has been assembled, the LIPAc beamline was operating in the intermediate configuration, namely the Phase B+ commissioning. The main objectives of this phase were to validate the 5-Mev/125-mA deuteron beam acceleration by the RFQ at a high-duty cycle and to characterize the beam properties in preparation for the final configuration with the SRF Linac. In June 2024, the Phase B+ commissioning was completed with the acceleration and transport of a 5 MeV/119 mA deuteron beam at 8.75% duty cycle up to the beam dump. This presentation will detail the outcomes of Phase B+.

Footnotes

Funding Agency

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Yes

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Session Classification: THIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **66** Contribution code: **THPT21**
Type: **Poster Presentation**

Development of Readout System for Target Multi-Wire Scanner Beam Profile Measurement of CSNS-II

Thursday, October 23, 2025 3:30 PM (2 hours)

Target Multi-Wire Scanner is a beam diagnostics device in the CSNS-II accelerator, designed to measure the pre-target beam profile. This paper details the hardware composition, software architecture, and beam-target interaction test results of the CSNS-II front-end multi-wire scanner readout system. In contrast to the CSNS predecessor, the upgraded system employs a hybrid software architecture combining a LabVIEW-based signal acquisition platform with a standardized EPICS Input/Output Controller (IOC) developed in C. The LabVIEW software handles signal acquisition and front-end electronics control, while processed data is transmitted to the EPICS IOC for standardized data publishing. This architecture enhances system stability and ensures reliable EPICS-based data interaction, demonstrating an optimized instrumentation framework for high-precision beam diagnostics in high-power proton accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LU, Zhijun (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **67** Contribution code: **THPT71**   Type: **Poster Presentation**

Xsuite for simulation of high-brightness, high-intensity hadron beams

Thursday, October 23, 2025 5:10 PM (20 minutes)

Accurate simulation of high-brightness, high-intensity hadron beams is essential for the design, commissioning, and optimization of modern accelerators such as the LHC injector complex, the LHC, and future high-energy machines. Beam dynamics is governed by complex multiparticle effects, including space charge, impedance-driven instabilities, intrabeam scattering, beam–beam interactions, and beam-halo losses. Xsuite is a modern, modular framework developed at CERN—implemented primarily in Python—designed to address the challenges posed by simulating these processes. It supports six-dimensional symplectic tracking with detailed modelling of nonlinearities, field errors, and collective effects; advanced models for space charge, impedance, beam–beam forces, and intrabeam scattering; and particle–matter interactions through its internal scattering engine together with interfaces to FLUKA and Geant4. Designed for high-performance computing, Xsuite leverages GPU acceleration and massive parallelization to enable large-scale simulations. This contribution outlines Xsuite's capabilities and illustrates its application in current and future accelerator projects.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: DE MARIA, Riccardo (European Organization for Nuclear Research)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **68** Contribution code: **WECDB01**   Type: **Contributed Oral Presentation**

Bunch Compression Methodologies in the ISIS Rapid-Cycling Synchrotron

Wednesday, October 22, 2025 5:00 PM (20 minutes)

The ISIS rapid-cycling synchrotron accelerates a high-intensity beam of protons from 70 MeV to 800 MeV at 50 Hz, facilitated by ferrite-loaded RF cavities at harmonics $h = 2$ and $h = 4$. The extracted proton beam is delivered along separate transfer lines to two tungsten spallation neutron targets, TS1 and TS2, at rates of 40 Hz and 10 Hz respectively. An intermediate carbon target on the TS1 line exploits ~ 4% of the full TS1 beam intensity for muon production. Compression of the extracted proton pulse helps to provide good temporal resolution for muon spin spectroscopy, speeding up measurements and widening the range of possible experiments. A bunch rotation method has been successfully employed at ISIS for several years, though it is sensitive to variations in extraction timing. A new method using the phase offset between the fundamental and 2nd harmonics of the ISIS ring RF has been developed as an alternative compression method without the same timing sensitivity. This work presents both compression approaches with experimental data, tomographic reconstructions, and supporting longitudinal beam dynamics simulations.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: KYLE, Billy (ISIS Neutron and Muon Source)

Session Classification: WECDB WGA contributed oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **69** Contribution code: **THPT42**   Type: **Poster Presentation**

Measurements of Linear Resonances and Stopbands on the ISIS Ring

Thursday, October 23, 2025 3:50 PM (20 minutes)

ISIS is the pulsed muon and neutron source at RAL in the UK. Its operation centres on an 800 MeV RCS cycling at 50 Hz and providing up to 3E13 protons per pulse corresponding to 0.2 MW mean beam power to the user targets.

Work is presently underway to improve the measurement, modelling, and control of the ISIS ring beam dynamics in order optimise operational setup as well as allow benchmarking of beam loss studies for the ISIS II upgrade.

As part of this work, new measurements of linear stopbands are being established. This paper outlines measurement of half integer stopbands exploiting low intensity, coasting beams and measurements of beam loss and profiles as tunes are ramped through resonance. Measurements are tested against applied, known, driving terms and compared with PyORBIT simulations. Initial results looking at integer stopbands and extending work to high intensity half integer resonance are also outlined.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **70** Contribution code: **THPT06**   Type: **Poster Presentation**

Beam dynamics design of a Superconducting RFQ for CiADS

Thursday, October 23, 2025 5:10 PM (20 minutes)

A superconducting radio-frequency quadrupole (SRFQ) is proposed for the future upgrade of the China Initiative Accelerator Driven System (CiADS). The SRFQ is de-signed to accelerate a 10 mA proton beam to 2.5 MeV within a compact length of 2.9 m. This design achieves 100% transmission efficiency and a carefully controlled output longitudinal emittance, ensuring minimal beam loss in the superconducting cavities. This paper presents the detailed beam dynamics design and its simulated performance.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **71** Contribution code: **THPT14**   Type: **Poster Presentation**

Compensation of third-order resonances in the presence of strong space-charge effect

Thursday, October 23, 2025 5:10 PM (20 minutes)

Resonance crossing, jointly determined by a large space-charge tune spread and magnetic field errors, is the main cause of beam loss and emittance growth in HIAF-BRing. For weak beams, the classical theory based on the resonance driving terms (RDTs) allows a perfect resonance compensation through precisely pre-known nominal TWISS parameters. As the space-charge gets intensified, however, the phase shift and beam envelope of particle's betatron oscillations are significantly modulated, which may lead to an inaccurate estimation on RDTs and hence an ineffective compensation. In this talk, a comparison will be made on the efficiency of a simultaneous compensation of multiple third-order resonances for two cases, (i) using nominal optics and (ii) considering the space-charge modulation on TWISS parameters, by numerical simulations. Besides, a procedure will be outlined for resonance compensation experiments in BRing, and a discussion will be given on how to apply the space-charge modulated TWISS in practical situations.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **72** Contribution code: **THPT37**   Type: **Poster Presentation**

MODIFIED ENVELOPE EQUATIONS WITH CONSIDERATION OF ACCELERATION AND ITS APPLICATIONS IN BEAM DYNAMICS STUDY

Thursday, October 23, 2025 5:10 PM (20 minutes)

This research presents a new numerical method of the beam envelope equations in the presence of acceleration. By using a scanning technique, a matched solution set with acceleration has been obtained. With focusing cases as constant wave number per unit length, it is found that the conventional adiabatic approximation theory fails when dealing with high acceleration gradients. Moreover, for matched cases, a scaling law of matched beam envelope as a function of beam energy is derived, which can be applied for the design and optimization for linacs. For mismatch cases, we found that the well-known wave number formula for mismatched envelope oscillations in the low-energy region requires revision when considering acceleration, since the oscillation wave numbers of low energy beams are largely affected by the accelerating effects. By using the Particle-Core Model (PCM) simulations, with acceleration, the amplitudes of particle trans-verse oscillations near the 2:1 resonance island are dramatically suppressed. This work could have potential applications on analysing and depressing beam dynamical instability with strong accelerating fields in future linacs.

Footnotes

Funding Agency

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Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **73** Contribution code: **THCBB03**   Type: **Contributed Oral Presentation**

Update on ESS icBLM system testing

Thursday, October 23, 2025 11:50 AM (20 minutes)

The European Spallation Source (ESS) in Lund, Sweden, is a pulsed neutron source based on a proton linac. The ESS linac is designed to deliver a 2 GeV beam with a peak current of 62.5 mA at 14 Hz to a rotating tungsten target for neutron production.

One of the most critical elements for protection of the accelerator is a beam loss monitoring (BLM) system. The system is designed to protect the accelerator from beam-induced damage and an unnecessary activation of the components.

The main ESS BLM system is based on ionisation chamber (icBLM) detectors. In the whole ESS linac, the total of 266 chambers were installed, connected, and powered. This contribution results from acceptance, installation and measurement campaigns made by several teams for the readiness of commissioning the BLM system with the beam, namely by the ESS beam diagnostics and integration groups, Warsaw University of Technology. Several tests were performed, in particular leakage current tests at CERN and ESS, installation and other resolved issues; self-integration, data acquisition, high voltage, Xray tests of the whole chain of icBLM system, and calibration test at HiRadMat facility at CERN.

Footnotes

Funding Agency

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Presenter: GRISHIN, Viatcheslav (European Spallation Source)

Session Classification: THCBB WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **74** Contribution code: **THIAC03**   Type: **Invited Oral Presentation**

The status and upgrade of magnet power supplies in J-PARC main ring

Thursday, October 23, 2025 9:30 AM (20 minutes)

During the long-term shutdown in FY2021, major upgrades of the main magnet system in the J-PARC Main Ring (MR) were carried out, including the installation of new power supplies, rearrangement of existing PSs, restructuring of magnet families, and cable re-wiring, contributing the beam extraction repetition period for the T2K experiment shortened from 2.48 s to 1.36 s, enabling operation at beam powers exceeding the MR original design of 750 kW. To further increase the beam power beyond 1 MW, the next goal is to reduce the repetition period even further. Technical challenges, such as the high output voltage and peak power receiving, are addressed by adding capacitors to the existing capacitor banks and fine-tuning control command values. In addition, various measures to mitigate beam loss are implemented, such as suppressing current ripple to reduce closed orbit distortion asymmetries, the individual fine-tuning of sextupole magnets to correct third-order resonances, etc.. This report presents the current status and the future prospects toward achieving higher output beam power.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THIAC WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **75** Contribution code: **TUIBC02** Type: **Invited Oral Presentation**

Self-field compensation utilizing nonlinear fields at the front-end of a linear ion accelerator

Tuesday, October 21, 2025 11:30 AM (20 minutes)

In high-intensity ion accelerators where beam density is high and beam velocity is low, the beam receives a significant impulse from the self field. This results in a sudden emittance growth over a short distance. This emittance growth manifests at the local level, necessitating the employment of analytical and suppression methods that differ from conventional approaches. Conventional methods presuppose periodic structures, whereas the present study employs methods that do not rely on such assumptions. In this presentation, we propose a series of research results, including an in-depth analysis of the conditions under which emittance growth occurs in regions where the influence of the self field is strong. We also put forward a novel suppression method and examine its efficacy.

Footnotes

Funding Agency

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Yes

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Session Classification: TUIBC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **76** Contribution code: **THIAC01**   Type: **Invited Oral Presentation**

H- ion sources at CSNS

Thursday, October 23, 2025 8:30 AM (30 minutes)

An RF-driven H$^-$ ion source has been developed and put into commissioning at the China Spallation Neutron Source (CSNS). The ion source features a silicon-nitride plasma chamber and an external antenna structure. It has demonstrated a maintenance interval exceeding 7,500 hours with nearly 100% availability.To achieve the goal of delivering a 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 the beam emittance. Research on beam intensity, space charge compensation, and stripped proton beam elimination has been conducted on the test bench with a new LEBT.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THIAC WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **77** Contribution code: **TUIAB02**   Type: **Invited Oral Presentation**

Random Resonance Compensation for further Beam Power Ramp-up in the J-PARC RCS

Tuesday, October 21, 2025 9:00 AM (30 minutes)

A detailed study on random resonances was conducted to facilitate further beam power ramp-up in the 3-GeV rapid cycling synchrotron of the Japan Proton Accelerator Research Complex. Systematic experiments employing a low-intensity beam revealed considerable excitation of the 2nd-order random resonances, namely horizontal half-integer and linear sum resonances, located just above the current operating point. The half-integer resonance was well compensated by using a trim quadrupole magnet, without simultaneously exciting the other higher-order resonances. Similarly, the linear sum resonance was found to be compensated by making local bumps in the location of sextupole fields. We identified the source of lattice imperfection driving the random resonances as the leakage field from extraction magnets by implementing a theoretical procedure based on resonance driving terms. These resonance compensation schemes have been confirmed to mitigate beam loss even for high-intensity beams and effectively improve the operating point tunability.

Footnotes

Funding Agency

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Presenter: KOJIMA, Kunihiro (Japan Atomic Energy Agency)

Session Classification: TUIAB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: 78 Contribution code: **FRCAA02**   Type: **Contributed Oral Presentation**

AI-Assisted Phase Space Inference and Beam Optimization

Friday, October 24, 2025 9:50 AM (20 minutes)

Reconstructing the full 6D phase space of a particle beam is a significant challenge, particularly the longitudinal (z–pz) component, which is difficult to measure without interfering with beam operation. We explore the use of artificial intelligence to infer this hidden information from more accessible transverse projections, such as x–px and y–py phase space images. This "virtual diagnostic" approach offers the potential for non-invasive monitoring and could support more precise, real-time beam control. Initial experiments using simulated data demonstrate the feasibility of high-dimensional reconstruction and lay the groundwork for future extensions.

In parallel, we propose a learning-based beam control method that integrates imitation learning and reinforcement learning in a unified framework. Instead of treating them separately, the algorithm dynamically adjusts their contributions during training—shifting from imitation to reinforcement as the policy improves. This hybrid strategy enables efficient learning in sparse-reward environments while ensuring stability. Tests in a virtual accelerator show stable convergence and improved beam intensity.

Footnotes

Funding Agency

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Yes

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Session Classification: FRCAA WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **80** Contribution code: **THCAC01**   Type: **Contributed Oral Presentation**

Linac4 Ion Source: Status, Performance, and Operation.

Thursday, October 23, 2025 10:00 AM (20 minutes)

The Linac4 H⁻ ion source plays a vital role for the CERN operation and experimental users. Its performance and availability have a direct and critical impact on the CERN's proton accelerator chain and the physics programs it supports. This paper presents an overview of the system, the operational experience and the lessons learned during the full five years of official running. Key topics as installation and maintenance strategy, spare parts management, cesiation procedure, automated RF power regulation and recent upgrade and improvements are discussed together with current performance metrics and availability figures.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LALLEMENT, Jean-Baptiste (European Organization for Nuclear Research)

Session Classification: THCAC WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **81** Contribution code: **TUIBC03**   Type: **Invited Oral Presentation**

Hadron Sources and Linacs activities in the Accelerator Beam Physics Group at CERN.

Tuesday, October 21, 2025 11:50 AM (30 minutes)

This paper reviews various activities regarding primary particle production for the entire CERN accelerator complex,the Linac3 lead ion and Linac4 H- operation and studies possible future upgrades and consolidation of the injectors. Besides lead ions, Linac3 provides a variety of different ions for the LHC and fixed target experiments. The Linac4 H- source was recently improved with a new extraction system that allowed reliable routine operation with unprecedented beam current and quality. A spare RFQ will be commissioned in 2025 at a dedicated test stand where the critical low-energy beam dynamics will be studied with a dedicated diagnostics line. The expertise and competences gained over the past decades with the renovation of the CERN injectors have been applied to sources and linacs for societal and medical applications: a series of compact MeV range accelerators based on the frequency of 750MHz have been built at CERN and in industry. They are used both at CERN and elsewhere for ion beam analysis and as a pre-injector for a linac- based hadron-therapy facility for protons or carbon ions.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LALLEMENT, Jean-Baptiste (European Organization for Nuclear Research)

Session Classification: TUIBC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **82** Contribution code: **THFA04**   Type: **Flash Poster Presentation**

Longitudinal localized kick driven fast extraction method for 3D PBS proton FLASH delivery

Thursday, October 23, 2025 2:45 PM (5 minutes)

The challenge of delivering FLASH irradiation to large volume targets within 100 ms using 3D pencil beam scanning (PBS) persists. A novel scanning scheme based on a rapid-cycling synchrotron (RCS) is proposed. This work introduces a longitudinal localized kick driven fast extraction method used in the scheme. By applying stripline kicker pulses to specific longitudinal segments of the bunch and dynamically adjusting the kick region based on real-time beam density, accurate spot dose delivery is achieved. Simulations show the results of spot dose accuracy and confirm controlled beam loss (<10%) during fall time, demonstrating the method's feasibility for 3D PBS proton FLASH therapy.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: XIONG, Yang (Tsinghua University)

Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **83** Contribution code: **THIAC02**   Type: **Invited Oral Presentation**

High intensity ion source activity at CEA

Thursday, October 23, 2025 9:00 AM (30 minutes)

CEA Paris-Saclay has been engaged in the development of high-intensity proton sources since the early 1990s, beginning with the SILHI ECR ion source, designed to inject beam into the IPHI accelerator. Still in operation today, SILHI has demonstrated long-term stability and reliability. To improve compactness and ease of maintenance, a redesign of the plasma chamber was initiated. This effort led in 2012 to the creation of ALISES, a prototype that marked the start of a new modular and scalable ECR source family, with multiple evolutions under study. The R&D program has since grown to include both experimental and simulation-based investigations. Recent developments feature for instance the integration and testing of a solid-state RF power amplifier as a replacement for the traditional magnetron on the BETSI test bench. Also, numerical simulations of plasma generation, RF coupling and extraction system are on-going to improve the ECR design thanks to new advanced optimization techniques that are being developed at CEA. This contribution summarizes the choices done for the development of ion sources as well as the recent R&D studies performed on these sources at CEA Paris-Saclay.

Footnotes

Funding Agency

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Yes

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Session Classification: THIAC WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **84** Contribution code: **TUIBB01**   Type: **Invited Oral Presentation**

Challenges and Progress of the dual-plane painting injection in the HIAF Booster Ring

Tuesday, October 21, 2025 11:00 AM (30 minutes)

High Intensity Heavy-ion Accelerator Facility (HIAF) is a giant accelerator facility aiming at high intensity primary and secondary beam preparation which is under construction in China. To achieve the challenging intensity goal, high intensity beam preparation remains a top priority of dynamics research. The first issue is how to accumulate in BRing with High injection gain(>56) and low beam loss(<5%). A dual-plane painting injection scheme is proposed, which performs horizontal and vertical painting simultaneously using a tilted electrostatic septum. The second issue is serious beam loss in early acceleration. The beam loss can induce dynamic vacuum effect, which is a more tougher intensity restriction issue than space charge effect. Mitigating the dynamic vacuum effect in the early stage is a critical approach to achieve a higher beam intensity. Therefore, a novel ES collimator is proposed. Dynamic simulation of the dual-plane painting injection of BRing reveals that the excellent performance of this scheme by a tenfold reduction in beam loss. The features associated with collimation efficiency and structure optimization are analyzed in detail.

Footnotes

Funding Agency

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Presenter: SHEN, Guodong (Institute of Modern Physics)

Session Classification: TUIBB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **85** Contribution code: **THPT35**   Type: **Poster Presentation**

Impact of longitudinal beam feedback on single-bunch instabilities

Thursday, October 23, 2025 5:10 PM (20 minutes)

Beam feedback systems are crucial in high-energy circular accelerators to suppress undesired bunch oscillations and prevent beam quality degradation. In the longitudinal plane, the CERN Super Proton Synchrotron (SPS) is equipped with beam phase and synchronization loops. The phase loop locks the RF phase of the accelerating voltage to the one of the bunches detected by a pickup, while the synchronization loop maintains the average RF frequency at a programmed reference. During the acceleration ramp, a bunch length excitation leading to significant emittance growth has been observed for different beam types. These longitudinal oscillations vanish when the beam feedback is disabled. A refined simulation model of the SPS beam control loops has been developed for the BLonD simulation suite, allowing to study the impact of longitudinal feedback on single-bunch instabilities. The findings suggest that the instability is intrinsic to the beam due to the radial mode-coupling of the sextupole azimuthal mode, albeit modified by the action of the loops.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **86** Contribution code: **THPT33**   Type: **Poster Presentation**

High-intensity beam tests in the CERN Proton Synchrotron

Thursday, October 23, 2025 5:10 PM (20 minutes)

A study campaign to identify potential limitations at highest intensities has been performed in the Proton Synchrotron (PS) in view of future requirements for fixed-target beams at CERN. Previous explorations of the maximum intensity date back more than two decades, and they required two injections from the PS Booster (PSB) with a long flat-bottom in the PS. This scheme resulted in unacceptably high beam loss. The limitations in the PSB have been removed with the upgrades in the framework of the LHC Injectors Upgrade (LIU) project. In combination with improvements to the PS RF systems, these upgrades enabled the acceleration of more than $4 \cdot 10^{13}$ protons for the first time. Coupled-bunch instabilities during the first part of acceleration are mitigated by a dipole mode feedback system. Additionally, careful adjustment of the working point at transition crossing was vital for reducing beam loss. A barrier-bucket RF system with a wideband cavity introduces a gap in the longitudinal distribution for the extraction kicker. The focus recently moved to evaluating the impact of beam induced voltage in this cavity, as well as the residual population of the gap.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: DAMERAU, Heiko (European Organization for Nuclear Research)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **87** Contribution code: **WEIDB01**   Type: **Invited Oral Presentation**

Beam dynamics studies on the ISIS RCS with a new assessment of non-linear driving terms and motion

Wednesday, October 22, 2025 4:30 PM (30 minutes)

ISIS is the pulsed muon and neutron source at RAL in the UK. Its operation centres on an 800 MeV rapid cycling synchrotron (RCS) running at 50 Hz, delivering 3×10^{13} protons per pulse and 0.2 MW average beam power to neutron targets.

Current studies are aiming to improve the measurement, modelling, and control of ISIS ring beam dynamics, with the goal of optimizing operational setup and benchmarking beam loss studies for ISIS and the proposed MW upgrade, ISIS-II. This paper gives a brief overview of linear and non-linear longitudinal and transverse beam dynamics studies at ISIS, as well as beam measurement and modelling. The paper then focuses on non-linear beam dynamics studies in the low-intensity regime.

Measured beam loss maps in tune space have been used to identify non-linear resonance lines. To better characterize individual resonance lines and improve the non-linear lattice model, comparisons are made between loss maps from experiment and results from extended particle tracking, Frequency Map Analysis (FMA) simulations, and analytical calculations. Detailed investigations of the third-order resonance lines 3Qx=13 and Qx+2Qy=12 are outlined.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WEIDB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **88** Contribution code: **THFA02**　　　　Type: **Flash Poster Presentation**

Applying radio frequency noise for longitudinal blow-up of debunched beam in the Large Hadron Collider

Thursday, October 23, 2025 2:05 PM (5 minutes)

The High-Luminosity upgrade of the Large Hadron Collider targets a yearly integrated luminosity of $300\,\mathrm{fb}^{-1}$. Following several hardware upgrades, the bunch intensity is foreseen to be raised to $2.2 \cdot 10^{11}$ protons per bunch. The resulting beam loading poses a challenge for the main radio frequency (RF) system of the LHC. The limited RF capture voltage and an enlarged fraction of unbunched beam can not be avoided, leading to start-of-ramp losses that exceed the dump threshold. This contribution explores how to reduce these losses by injecting phase noise into the LHC RF system during the flat bottom. This band-limited RF noise can diffuse the particles outside the separatrix to higher momentum offsets. Together with the LHC collimation system, in principle, this method could help to clean out the debunched particles. An extensive campaign of simulations using the Beam Longitudinal Dynamics (BLonD) code has been performed to tune the frequency band of excitation and to predict the resulting cleaning efficiency of the proton beam in the Large Hadron Collider.

Footnotes

Research supported by the HL-LHC project.

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **89** Contribution code: **THPT09**   Type: **Poster Presentation**

Beam loss mechanism by parasitic negative hydrogen in high power proton linac

Thursday, October 23, 2025 5:10 PM (20 minutes)

Beam loss is the most critical topic in the high power accelerator community. During high power proton beam commissioning of Chinese ADS Front end (CAFe), unexpected irradiation dose was detected opposite to the proton beam deflection direction. This indicates there are parasitic negative hydrogen particles inside the proton beam, which is first observed in the linac facility. In the paper, regarding this beam loss phenomenon, a qualitative analysis and a quantitative analysis was conducted and finally verified this beam loss mechanism, which needs to be considered in the future design of high intensity and high power proton accelerators. Ultimately, several solutions are proposed for this beam loss mechanism.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **90** Contribution code: **MOLDA02**   Type: **Plenary Presentation**

High Intensity Beam Dynamics Study and Status of HIAF

Monday, October 20, 2025 4:10 PM (30 minutes)

HIAF project is a major national science and technology infrastructure project in China which aims at providing high intensity ion bunches at the repetition frequency of 3 Hz for scientific research or industry applications from international users. In the complicated manipulations that generate those high intensity beams, diverse high intensity effects, especially space charge effects, collective instabilities, dynamical vacuum effects, etc., and their coupling effects have many detrimental impacts on the final beam intensity and quality. Several beam dynamics simulation platforms are developed, and the theory or simulation studies are performed to build corresponding solutions which are already installed in the HIAF, including resonance correction sextupole magnets, digital feedback systems, collimators for ions whose charge states are changed by residual gas, and so on. The beam commissioning of the whole HIAF facility will be performed soon, and day one experiments will also be conducted at the end of this year. All compensation schemes of high intensity effects will be employed gradually in the future beam commissioning to drive continuous performance improvement of the HIAF.

Footnotes

Funding Agency

National Key R&D Program of China No. 2023YFA1606800

I have read and accept the Privacy Policy Statement

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Session Classification: MOLDA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **91** Contribution code: **THFA12**　　　　　Type: **Flash Poster Presentation**

Longitudinal Phase Space Reconstruction from Beam Current Projections Using Deep Convolutional Neural Networks

Thursday, October 23, 2025 2:55 PM (5 minutes)

We propose an end-to-end deep learning method for reconstruction of proton synchrotron longitudinal phase space distributions from 1D beam current projections. Unlike iterative tomographic approaches, our model bypasses complex physics computations by establishing a direct sequence-to-image mapping. The architecture integrates sinusoidal positional encoding to capture multi-turn temporal dependencies and attention pooling to weight critical frames. Spatial reconstruction uses convolutional upsampling. Trained on 10,000 simulated datasets generated with XiPAF parameters, the model achieves high-fidelity results with average KL divergence <0.1 and SSIM >0.7 on validation data. Compared to Algebraic Reconstruction Technique (ART), our method maintains equivalent projection discrepancy (<0.04) while reducing reconstruction time from ˜3 minutes to ˜100 ms per image −a 3-order-of-magnitude acceleration. Current 128×128 pixel resolution limitations will be addressed in future work. This framework enables real-time beam diagnostics for high-intensity hadron accelerators.

Footnotes

*Simulation parameters: E_s=10 MeV, L=30.9 m, V_{rf}=100 V, h=1, γ_T=1.64468

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter:　LUO, Yixuan (Tsinghua University)

Session Classification:　THFA WGs flash talks

Contribution ID: **92** Contribution code: **THFA07**   Type: **Flash Poster Presentation**

Scenario of beam-based alignment with new BPM system for future beam commissioning of 1.3-MW operation at the J-PARC Main Ring

Thursday, October 23, 2025 2:55 PM (5 minutes)

At the J-PARC Main Ring, a project is in progress to upgrade the beam power to 1.3 MW for the neutrino oscillation experiment. Control of the optics and beam orbit relative to the magnetic center of the accelerator components is crucial to suppress beam losses in intense beams. We need to reduce the determination error of the beta function from the current value of 2% to less than 1%. Furthermore, the closed-orbit offset from the magnetic center must be set within 10μm to weaken the effect of the resonances, while its precision is 30μm up to now. To satisfy such targets, ongoing upgrades of the data acquisition system for the BPMs will improve the accuracy to one-third than the current value. As a first step to requested fine measurements of optics parameters, we calculated how small an offset with respect to the magnetic center we can obtain via beam-based alignment with the new BPM circuits by simulation. We discussed the upgrade of the method for beam-based alignment to satisfy the requirements of the orbit correction to reduce the effect of the resonance in our system.

Footnotes

Funding Agency

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Yes

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Session Classification: THFA WGs flash talks

Track Classification: WGD:Operations and Commissioning

Contribution ID: **93** Contribution code: **THFA10**   Type: **Flash Poster Presentation**

Measurement and Analysis of Beam Intensity for the C-band Photocathode Electron Gun Platform

Thursday, October 23, 2025 2:55 PM (5 minutes)

This paper presents an overview of the beam intensity measurement system for the C-band photocathode electron gun platform, detailing the observed phenomena during measurements and the associated experimental investigations. The system's design, operational principles, and key components are introduced, followed by an analysis of critical measurement results and unexpected behaviors, such as dark current interference and beam instability. Corresponding experimental validations and optimization strategies are discussed to enhance measurement accuracy and platform performance, providing insights into the dynamic characteristics and reliability of the electron gun system.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THFA WGs flash talks

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **94** Contribution code: **THPT39**   Type: **Poster Presentation**

Longitudinal Localized Excitation Slow Extraction Method

Thursday, October 23, 2025 5:10 PM (20 minutes)

Resonant slow extraction is widely utilized in hadron synchrotron accelerators. This paper proposes a longitudinal localized excitation method for slow extraction, in which transverse excitation is applied only within a limited phase interval located at the edge of the longitudinal phase space. As a result, only particles situated in this region are excited and subsequently extracted. This approach offers several advantages, including mitigating adverse space charge effects, reducing spill fluctuations, and enabling adjustment of the extracted beam's momentum spread. These capabilities make the method suitable for various applications with specific beam requirements. Several application examples of the longitudinal localized excitation slow extraction method are presented in this paper.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: 95 Contribution code: **THPT84**   Type: **Poster Presentation**

Development of a Machine Learning tool for LEBT Optimisation at ISIS

Thursday, October 23, 2025 4:50 PM (30 minutes)

At the ISIS Neutron and Muon Source, accelerator tuning has traditionally been a manual process, relying on expert operators to adjust control system parameters to achieve optimal beam efficiency and intensity. With the recent migration of the control system to EPICS and the availability of optimization frameworks such as Xopt, we have initiated the first efforts to automate tuning of the Low Energy Beam Transport (LEBT) at ISIS. In this presentation, we outline the specific optimization problem being addressed, detail the measures taken to ensure safe application of Bayesian Optimisation (BO), and share results from our optimization runs. We will also present the graphical user interface (GUI) that we have built for our operators for running optimisations during user cycle. Finally, we discuss the challenges encountered during this process and outline future work aimed at overcoming these limitations and improving automation reliability.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LIU, Xingchi (Science and Technology Facilities Council)

Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **97** Contribution code: **THPT51**   Type: **Poster Presentation**

Reducing Energy Spread of Low-Energy Slow Extracted Beam Using Longitudinal Localized Excitation Method

Thursday, October 23, 2025 5:10 PM (20 minutes)

High-current or low-energy slow extraction from proton synchrotron suffers from strong space charge effect. Longitudinal localized excitation slow extraction method is proposed in this paper to reduce the spill energy spread while mitigating space charge effects. This method applies transverse excitation within a limited phase interval which locate at the edge of the longitudinal phase space.

By using SynTrack particles tracking code, we simulated low-energy slow extraction under strong space charge conditions for two cases: global excitation and localized excitation. The simulation results indicate that the momentum spread of the extracted beam in localized excitation mode can be significantly lower than that in the global excitation mode.

Due to the influence of longitudinal motion, excited particles may also move out of the excitation phase interval before being extracted, so it cannot be fully guaranteed that the extracted particles remain within the excitation phase interval. The mechanism of this leakage phenomenon and corresponding suppression methods are investigated.

Furthermore, the hardware design implementing the localized excitation function were presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LI, Chuhao (Tsinghua University)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **98** Contribution code: **THPT48**   Type: **Poster Presentation**

Preliminary Design of a Compact High-Flux Neutron Source Based on a Proton Linac

Thursday, October 23, 2025 5:10 PM (20 minutes)

Abstract

With the advancement of high-intensity proton linacs, compact neutron sources with a limited footprint have become feasible. Such a neutron source, consisting of a radio frequency (RF) ion source, a radio frequency quadrupole (RFQ), and a rotating Li target, operating in continuous wave (CW) mode, has been proposed. In this paper, we present the overall system design and considerations for beam dynamics. New techniques such as space charge compensation are employed to address the space charge effect. A preliminary beam dynamics design is described, featuring ultra-low beam loss, which is critical for such a system. The potential applications and key advantages of this compact high-flux neutron source are also briefly discussed.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LIU, Xingguang (Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **99** Contribution code: **THPT57**   Type: **Poster Presentation**

Simulation Study on Magnet and RF Failures in the Linear Accelerator of CSNS-II

Thursday, October 23, 2025 5:10 PM (20 minutes)

The China Spallation Neutron Source (CSNS) is a large multidisciplinary experimental facility that generates neutrons by targeting a strong current proton accelerator. Its linear accelerator consists of a front-end accelerator, a 3 MeV RFQ accelerator, and an 80 MeV DTL accelerator. The second phase of the project will upgrade the linear accelerator by installing superconducting cavities after the DTL exit, increasing the beam energy to 300 MeV. This paper will present a simulation study that examines the effects of different magnets and cavity failures in the linear accelerator on beam quality, including emittance growth and beam loss.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: YUAN, Yue (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **100** Contribution code: **THCAB01**   Type: **Contributed Oral Presentation**

The Effect of Magnet Alignment on Closed Orbits in the ISIS Rapid Cycling Synchrotron

Thursday, October 23, 2025 10:00 AM (20 minutes)

The ISIS Rapid Cycling Synchrotron (RCS) operates at a repetition rate of 50 Hz and delivers high-intensity proton beams of up to 3×10^{13} protons per pulse at 800 MeV to two neutron and one muon production targets. Maintaining control over the closed orbit is essential to optimal performance. Magnet alignment surveys are now regularly carried out during accelerator shutdowns, translated into misalignments, and applied to a cpymad model of the RCS. The model is used to identify realignment candidates and infer the bare (uncorrected) orbit. This paper includes comparison of inferred and measured bare orbits, and the operational implications of realignment based on the model. The approach demonstrates the value of integrating magnet alignment survey data with beam dynamics modelling to inform machine setup and improve operational performance in high-intensity synchrotrons.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: KYLE, Billy (ISIS Neutron and Muon Source)

Session Classification: THCAB WGD contributed oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **101** Contribution code: **THFA03**   Type: **Flash Poster Presentation**

Simulation Study of Space Charge Effects on Transverse Coupled-Bunch Instabilities

Thursday, October 23, 2025 2:10 PM (5 minutes)

Coupled-bunch instabilities will occur with long-range wakefields. And it's an effective way to adjust the chromaticity to suppress transverse coupled-bunch instabilities. There are some theoretical studies showing that strong space charge can weaken the suppression effect of chromaticity. In this paper, transverse coupled-bunch instabilities with space charge are simulated and analysed using PyORBIT and PyHEADTAIL. Results reveal that under strong space charge, the oscillation modes depend solely on the longitudinal position, which weakens the effect of chromaticity, with higher-order modes (l is large) becoming dominant. When space charge is extremely strong, only the l = 0 mode remains observable.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: RAO, Li (Institute of High Energy Physics)

Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **102** Contribution code: **TUIDC01**   Type: **Invited Oral Presentation**

CERN Proton Synchrotron Booster High-Intensity Operation

Tuesday, October 21, 2025 4:00 PM (30 minutes)

The CERN Proton Synchrotron Booster (PSB) produces a wide variety of high intensity and high brightness beams for the fixed target experiments and the Large Hadron Collider (LHC). As part of the LHC Injectors Upgrade (LIU) project, many upgrades were made to the accelerator, including a new injector, Linac4, increased injection and extraction energies, charge exchange injection and new RF systems. With the approval of the Search for Hidden Particles (SHiP) facility, a new era of PSB operation approaches that will require higher intensities to ensure the requirements of existing facilities are still met. This contribution will discuss optimisations that have been implemented for present and upcoming operational beams as well as longer term studies to probe the ultimate performance limit of the accelerator.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: MARCHI, Mariangela (European Organization for Nuclear Research)

Session Classification: TUIDC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **103** Contribution code: **THFA05**   Type: **Flash Poster Presentation**

Longitudinal limitations in the CERN Proton Synchrotron Booster

Thursday, October 23, 2025 2:20 PM (5 minutes)

The CERN Proton Synchrotron Booster (PSB) operates at two nominal extraction energies, 1.4 GeV and 2 GeV, each presenting distinct achievable beam intensities. To mitigate longitudinal instabilities, the PSB RF system employs a combination of double-harmonic voltage and multi-harmonic cavity feedback loops. When operating with single-harmonic voltage and open cavity loops, a fast instability emerges. In contrast, closing the loops suppresses the fast instability but results in gradual longitudinal emittance growth. Longitudinal stability improves significantly when the second harmonic is added in counter-phase at the bunch position, but not in-phase, despite both configurations increasing the synchrotron frequency spread. A new time-domain model of the cavity loops has been incorporated into particle tracking simulations, which allows a more detailed understanding of their influence on beam dynamics. This contribution presents results from a simulation and measurement campaign, which have been used to identify present longitudinal limitations and predict future performance.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: MARCHI, Mariangela (European Organization for Nuclear Research)

Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **104** Contribution code: **TUICB01**　　　Type: **Invited Oral Presentation**

Tuning and stabilization of long normal conducting RF cavities

Tuesday, October 21, 2025 1:30 PM (30 minutes)

The tuning and stabilization of long normal conducting radiofrequency cavities present specific challenges that are critical for the reliable operation of linear accelerators. When the cavity length exceeds the RF wavelength several times, small mechanical deformations, misallignement and thermal gradients can lead to significant detuning, acceleting field distortion and excitation of unwanted modes.

These effects are particularly relevant for structures such as Drift Tube Linacs and Radio Frequency Quadrupoles, which operate in the low-energy sections of linacs, where compliance of the design accelerating field profile and frequency stability are essential for efficient beam transport and acceleration: this requires careful stabilization strategies. In this contribution the experience with the DTL of the ESS linac, as well as from RFQs developed in the Anthem and SPES projects, will be presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: TUICB WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **105** Contribution code: **THPT63**   Type: **Poster Presentation**

The isochronous mode operation with nonlinear optics characteristics of the SRing at HIAF

Thursday, October 23, 2025 5:10 PM (20 minutes)

Exotic nuclei far away from the valley of β-stability are characterized by tiny production cross-sections and short half-lives, therefore highly efficient and fast mass measurement techniques are required. The Spectrometer Ring (SRing) at the HIAF provides such conditions for accurate mass and unique half-life measurements of exotic nuclei. The SRing is designed as a multi-function experimental storage ring, which will be operated in different modes. The high priority research program of the SRing is to measure systematically nuclear masses in broad regions. Firstly, the isochronous mode of the SRing is used as a novel isochronous mass spectrometer (IMS) named the Bρ-defined IMS with two TOF detectors for very short-lived exotic nuclei. Secondly, the normal mode is designed to prepare high-quality Rare Isotope Beams (RIBs) for Schottky mass spectrometry experiments (SMS) and in-ring nuclear and atomic physics experiments. The structure of the ring lattice and its ion-optical properties in the isochronous mode are described. Nonlinear ion-optical characteristics and their influence on an achievable mass resolving power in an isochronous mode operation of the SRing are discussed.

Footnotes

Funding Agency

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Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **106** Contribution code: **THPT46**   Type: **Poster Presentation**

Parametric resonance in a heavy ion synchrotron

Thursday, October 23, 2025 5:10 PM (20 minutes)

The Heavy Ion Research Facility in Lanzhou (HIRFL) is a globally significant full-ion acceleration system. Its Cooler Storage Ring (CSR) facility demonstrates versatile capabilities in beam accumulation, cooling, and acceleration. During operational cycles, periodic beam losses have been observed, prompting an investigation into their root causes.Our study focused on analyzing analog dipole magnet power supply ripple currents and magnetic field fluctuations. Through combined experimental measurements and numerical simulations, we established a causal relationship: magnetic field jitter induced orbit distortion, which perturbed beam phase and triggered parametric resonance. The phenomenon was particularly pronounced when the synchrotron tune approached the ripple frequency during acceleration cycles.To address this issue, we replaced the legacy analog power supply system with a digital counterpart. This upgrade achieved a 10-100× reduction in ripple amplitude, effectively suppressing the previously observed beam losses associated with parametric resonance. The findings provide valuable insights for optimizing heavy ion accelerator performance in similar facilities.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **107** Contribution code: **THPT08**   Type: **Poster Presentation**

Beam Dynamics of a High-frequency RFQ with Nested Solenoid

Thursday, October 23, 2025 5:10 PM (20 minutes)

To make ion accelerators in applications more compact, the Institute of Modern Physics, Chinese Academy of Sciences is dedicated to researching the radio frequency quadrupole (RFQ) operating at a frequency as high as 1 GHz. While high frequency can effectively enhance the acceleration gradient of RFQ, it also leads to low transverse focusing force, reduced acceptance and decreased transmission efficiency. To solve these problems, this paper proposes a novel high-frequency RFQ - nesting a solenoid outside the RFQ cavity to provide additional transverse focusing force, thereby increasing acceptance and improving transmission efficiency. By optimizing the dynamic parameters of RFQ and solenoid, the beam dynamics design of a 7.0 MeV proton RFQ has been successfully completed. This RFQ achieves a beam transmission efficiency of up to 91%, with a total length of only 2.3 meters and an effective acceleration gradient of 3.0 MV/m.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Co-author: YIN, Xuejun (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: LI, Zhongshan (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **108** Contribution code: **THPT53**   Type: **Poster Presentation**

Research on High-Intensity Proton IH-DTL Accelerating Structure Based on APF

Thursday, October 23, 2025 5:10 PM (20 minutes)

Proton linear accelerators are crucial in spallation neutron sources, CANS, proton therapy, etc. DTL, especially Alvarez-type, is used for intense pulsed proton beams at several to tens of MeV. High-intensity neutron sources characterized by superior temporal resolution, unprecedented peak brightness demand higher pulse current intensity proton linear accelerator. With the in-depth research on the DTL structure, improved DTL variants such as the IH and CH structures have been applied. And the advances in solid-state power source technology make short-cavity structures with inter-cavity magnetic focusing promising to boost acceleration efficiency and reduce beam losses.

The short-cavity IH-DTL studied in this poster offers advantages such as modular optimization capability and stable electromagnetic performance.The poster focuses on APF IH-DTL with single short-cavity research, accelerating 2.5 MeV protons with an 80 mA pulse current , has been accelerated by RFQ and transported through MEBT, to 4.5 MeV via Beampath, Matlab and CST. The structure is obtained, consisting 15 Tubes and 14 Gaps, with a length of 0.91 m, a radiu of 0.2 m, an outlet phase width of 37.3° at the inlet of the next short-cavity (about 50 cm along the exit drift section) , and 80 mA high-intensity proton beams with a transmission efficiency of 99.2%.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: LI, Shilin (China Institute of Atomic Energy)

Co-author: YANG, Jinghe (China Institute of Atomic Energy)

Presenters: YANG, Jinghe (China Institute of Atomic Energy); LI, Shilin (China Institute of Atomic Energy)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **110** Contribution code: **THCBC01**   Type: **Contributed Oral Presentation**

Overview of present and future hadron beam collimation

Thursday, October 23, 2025 11:30 AM (20 minutes)

The collimation system of the Large Hadron Collider (LHC) at CERN represents the state of the arc of multi-stage collimation systems. It provides an excellent cleaning performance that has so far ensured safe and efficient operation of the LHC with beam stored energies up to 430 MJ. However, further improvements are needed in view of the High-Luminosity upgrade of the LHC (HL-LHC) that will start operation in 2030. The performance of the LHC beam collimation is reviewed, addressing in particular a first-phase upgrade that was deployed for the LHC Run 3 (2022-2026). The remaining challenges for the HL-LHC and the solutions being implemented are then reviewed. Applications to future colliders under study are also discussed.

Footnotes

Work presented on behalf of the LHC collimation teams

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: REDAELLI, Stefano (European Organization for Nuclear Research)

Presenter: REDAELLI, Stefano (European Organization for Nuclear Research)

Session Classification: THCBC WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **112** Contribution code: **THPT34**   Type: **Poster Presentation**

High-performance open-source beam dynamics simulation platform: PASS

Thursday, October 23, 2025 5:10 PM (20 minutes)

HIAF is a high-intensity particle accelerator that will perform injection, acceleration, and extraction at a repetition rate of 3 Hz. The beam will be affected by a variety of high-intensity effects. In order to increase the beam intensity, we hope to fully and accurately simulate the impact of those effects so that we can take appropriate suppression measures. For this purpose, we are developing a new simulation platform PASS (Particle Accelerator Simulation Studio). PASS will provide sufficient computing power to support the simulation of multi-effect coupling through large-scale parallel algorithms, and PASS will be an open-source project, hoping to be more widely used and receive feedback. At present, the framework of PASS has been built, providing a very convenient interface for different effects. Through the input file, the free combination of various physical effects can be realized. We have realized the embedding of space charge and beam-beam effect, and the embedding of other effects such as impedance is in progress.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **113** Contribution code: **WEIDC01**　　　　Type: **Invited Oral Presentation**

Accelerator Design for the High Brilliance Neutron Source (HBS)

Wednesday, October 22, 2025 4:30 PM (30 minutes)

The High Brilliance Neutron Source (HBS) is a new High Current Accelerator-driven Neutron Source (HiCANS) project, planned and to be realized at the Forschungszentrum Jülich, Germany. The project represents a promising alternative for expanding neutron availability in Europe by using a high-current, low-energy proton accelerator and state-of-the-art technologies to deliver thermal neutron fluxes comparable to medium to high flux reactor sources, supporting both scientific and industrial applications.

The driver accelerator is designed to reliably accelerate a 100 mA proton beam to 70 MeV, which will then be distributed pulse-by-pulse via a multiplexer to three different neutron targets, each operating with a distinct time structure.

The planned linear accelerator (LINAC) consists of an ECR source, a LEBT section, two RFQs, and more than 45 normal-conducting CH drift tube structures.

This talk will present the layout of the proposed normal-conducting HBS accelerator, with a particular focus on the challenges in the design of the resonators and the beam dynamics of the CH drift tube section.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WEIDC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **114** Contribution code: **THPT41**   Type: **Poster Presentation**

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

Thursday, October 23, 2025 5:10 PM (20 minutes)

Dipole magnet vacuum chambers are among the critical and costly components of rapid-cycling accelerator facilities. Alternative
approaches to traditional ceramic chambers have been explored for the implementation of fast-ramping dipole-magnet vacuum chambers,
including thin-wall metallic beam pipe chambers strengthened with transverse ribs. Here, we report a novel 3D-printed titanium alloy
cage inside the thin-wall vacuum chamber. Because the beam impedance aspects are highly important for beam stability, comprehensive
studies were undertaken to characterize the impedance of the 3D-printed titanium alloy cage inside thin-wall vacuum chamber. The beam
coupling impedance of the new thin-wall vacuum chamber were studied numerically. Strategies for further reducing the beam-coupling
impedance were explored. In addition, impedance bench measurements using the "half wave-length" resonant method were conducted to
identify the longitudinal and transverse impedance of this thin-wall vacuum chamber prototype experimentally. The simulated and
measured results for the impedance were consistent. This novel thin-wall vacuum chamber structure has been installed in the BRing.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **115** Contribution code: **THCBB01**   Type: **Contributed Oral Presentation**

SOFT: Single-Optics 4D phase space Tomography via double-rotated 2D measurements

Thursday, October 23, 2025 11:30 AM (20 minutes)

Detailed knowledge of high-dimensional phase space distributions is crucial for predicting and controlling the evolution of intense beams. Conventional beam tomography techniques require measurements under multiple beamline configurations, introducing reconstruction errors due to transport nonlinearities and model uncertainties while complicating the beamline design. This paper introduces SOFT (Single-Optics Four-dimensional Tomography) , a novel technique that reconstructs the complete 4D distribution using measurements from a single beamline setting. SOFT conducts 2D phase space scans with two independently rotatable slits to extract otherwise inaccessible cross-plane information. We present a rigorous proof demonstrating SOFT's ability to acquire sufficient data for full 4D reconstruction. Physics-informed analytical tools based on 4D geometry were developed to optimize the design and minimize measurement errors. SOFT's efficacy is validated through simulations, and the status of the prototype experiment is discussed.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THCBB WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **116** Contribution code: **FRCAA01**   Type: **Contributed Oral Presentation**

Automation of GSI key beam manipulations with AI methods

Friday, October 24, 2025 9:30 AM (20 minutes)

We present the Geoff framework for automated accelerator tuning, demonstrated in real-world experiments at GSI. Using classical optimizers like BOBYQA, Geoff enables fast deployment, control room integration, and efficient beam optimization, reducing SIS18 injection losses from 45% to 15% and speeding up FRS setup.

This work also reports the first application of multi-objective and multi-fidelity Bayesian optimization to SIS18 injection tuning. Complementary simulation studies employ model predictive control via model-based reinforcement learning for fast, constraint-aware tuning. These model-based methods outperform classical optimizers by guiding experiments with probabilistic surrogate and dynamic models.

Geoff's modular design supports easy switching between algorithms and integration with modern ML tools, bridging accelerator operations and data-driven optimization.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: APPEL, Sabrina (GSI Helmholtz Centre for Heavy Ion Research)

Session Classification: FRCAA WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **117** Contribution code: **TUIAB03**   Type: **Invited Oral Presentation**

Recent optics measurements and corrections for high-intensity operation of the J-PARC Main Ring

Tuesday, October 21, 2025 9:30 AM (30 minutes)

In the intensity-frontier proton synchrotron J-PARC Main Ring (MR), a power upgrade plan is underway to achieve 1.3 MW beam power for neutrino experiments. The upgrade has generally progressed as planned, with the beam power for the user operation reaching 830 kW as of May 2025. A major obstacle to upgrading the beam power of the MR is the radioactivation of accelerator components caused by beam loss. One significant contributor to beam loss is the betatron resonances, which are sensitive to the symmetry of optics. Precise optics corrections during beam tuning have therefore been playing a critical role in suppressing these resonances and reducing beam losses. This paper presents the strategies and recent results of optics measurements and corrections for the MR.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ASAMI, Takashi (High Energy Accelerator Research Organization)

Session Classification: TUIAB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **118** Contribution code: **WECDC01** Type: **Contributed Oral Presentation**

AI techniques and strategies for Linac tuning at LNL

Wednesday, October 22, 2025 5:00 PM (20 minutes)

Based on the operational experience on the superconducting heavy ion linac ALPI, we introduced Machine Learning techniques to improve the performances and speed up the tuning of the ion linac at LNL.

The technique proved to be particularly effective to overcome issues on the longitudinal matching. The algorithm has been adapted to be compatible with high intensity linacs, in terms of transverse and longitudinal acceptance, available diagnostics and machine protection prescriptions.

After a detailed preparatory simulation work, the algorithm has been tested during the 2025 commissioning shift of the ESS linac.

In this paper the results obtained in the ALPI and ESS campaigns.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WECDC WGB contribute oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **119** Contribution code: **THPT49**   Type: **Poster Presentation**

Progress of CNT multi-wire beam profile monitor for CSNS-II

Thursday, October 23, 2025 5:10 PM (20 minutes)

In the China Spallation Neutron Source II (CSNS-II), the H⁻ beam will be accelerated in the Linac to 300 MeV. Subsequently, the electrons are stripped from the H⁻ ions through a stripping foil during injection into the Accumulator Ring, converting them into a proton beam. Wire scanners are employed to measure the transverse beam profile and emittance in the injection area. This paper presents thermal analysis of the wire scanners in the Linac. To meet measurement requirements, the beam pulse length will be 575 µs, and the current will be approximately 30 mA. Given these parameters, carbon nanotube (CNT) or tungsten wires are considered as potential materials for measuring beam profiles throughout the facility. However, when the beam pulse length exceeds 200 µs, the temperature of a 33 µm tungsten wire surpasses its sublimation threshold (3000 K), approaching its melting temperature. This analysis compares the temperature of different wire materials. The results indicate that under the specified beam parameters, CNT wires exhibit a significantly lower temperature increase, making it the optimal choice.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LU, Zhijun (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **120** Contribution code: **WECCC04** Type: **Contributed Oral Presentation**

Beamline Physics Design and High-Brightness Beam Optimization for the CSNS-II Linac

Wednesday, October 22, 2025 3:10 PM (20 minutes)

Commissioning of the China Spallation Neutron Source (CSNS) began in 2018, achieving a neutron production beam power of 100 kW. An upgrade program CSNS-II launched in 2024 aims to reach 500 kW within the next few years. Throughout these developments, several multidisciplinary application facilities have been deployed or are planned for deployment: Associated Proton Beam Experiment Platform, Back-n White Neutron Source Station, High Energy Proton Experiment Station, Muon Station for Science, Technology and Industry (MELODY), Isotope Production Platform. In this report, those application stations and their related physics beam line design will be presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: HAN, Yanliang (Institute of High Energy Physics)

Session Classification: WECCC WGB contributed oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **121** Contribution code: **TUIBB03**   Type: **Invited Oral Presentation**

Commissioning of NICA injection complex

Tuesday, October 21, 2025 12:00 PM (30 minutes)

Construction of the NICA collider is approaching to its end with the beam circulation in the collider rings expected by the beginning of 2026. Successful collider commissioning requires obtaining high intensity heavy ion beams in its injector string. The talk discusses up-grades of the injection complex aimed at radical increase of the injection complex intensity. In general, there are two major efforts. The first one is the beam accumulation in Booster with help of electron cooling; and the second one is a drastic reduction of beam loss in the course of beam acceleration. This work actually includes large number of different efforts ranging from solving simple engineering problems to the detailed measurements and correction of beam optics for all rings and transfer lines, optimization of beam acceleration, as well as optimization of beam accumulation with electron cooling.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LEBEDEV, Valeri (Joint Institute for Nuclear Research)

Session Classification: TUIBB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **122** Contribution code: **THPT26**　　　　　Type: **Poster Presentation**

Effect of intrabeam scattering on the bunched beam Schottky noise

Thursday, October 23, 2025 5:10 PM (20 minutes)

In the case of "linear RF system"the longitudinal Schottky noise of bunched beam is presented as a set of synchrotron lines around each revolution harmonics or, in the case of transverse Schottky noise, around each betatron sideband. In a typical accelerator or storage ring the RF system generates harmonic RF which makes the synchrotron motion non-linear resulting in a dependence of synchrotron frequency on the amplitude and, consequently, widening the synchrotron lines. The width of these lines increases linearly with harmonic number. The intrabeam scattering (IBS) results in random uncorrelated jumps in momenta of different particles. Consequently, these jumps result in jumps in particle phase and amplitude yielding additional widening of synchrotron lines. Since IBS, as well as other diffusion mechanisms, produces particle displacement proportional to the square root of time the line widening due to IBS goes quadratically with harmonic number leading to the dominant contribution of IBS to the line widening at very high frequencies. The talk presents a theoretical model describing effect of IBS on the Schottky noise of bunched beam and discusses its effect in real accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LEBEDEV, Valeri (Joint Institute for Nuclear Research)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **123** Contribution code: **THFA06**   Type: **Flash Poster Presentation**

Longitudinal beam stacking in storage ring using pulsed e-cooling

Thursday, October 23, 2025 2:55 PM (5 minutes)

Longitudinal ion beam stacking in a storage ring using a barrier rf system combined with beam cooling has been successfully demonstrated in several experiments. Based on the bunching effect observed in the pulsed electron beam cooling experiment at HIRFL-CSRm, we propose a new beam stacking scheme using only pulsed electron beam, in which the barrier voltage and cooling process can be achieved simultaneously. In this paper, we introduce this longitudinal stacking scheme along with the theory of beam dynamics and present a simple analytical model. The simulation demonstrates that this approach could be a useful beam stacking technique without the need for barrier bucket hardware. Moreover, the optimization and limitation of this stacking scheme are discussed, and the effect of the electron beam distribution on the barrier voltage is studied. This stacking method is expected to be a promising tool for accumulating RIBs in low- and medium-energy storage rings, such as the SRing of the HIAF project, where high-precision experiments require efficient accumulation techniques.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Authors: ZHAO, He (Institute of Modern Physics, Chinese Academy of Sciences); MAO, Lijun (Institute of Modern Physics)

Presenter: ZHAO, He (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **124** Contribution code: **THPT02**   Type: **Poster Presentation**

Application of autoresonance in rapid beam extraction of synchrotrons

Thursday, October 23, 2025 5:10 PM (20 minutes)

Ultra-high dose rate (FLASH) radiotherapy is emerging as a novel cancer treatment due to its tumor-killing efficacy and superior normal tissue protection compared to conventional therapy. However, in compact synchrotrons, achieving the required FLASH dose rates is challenging, since conventional RF-KO extraction struggles to achieve the short (tens of milliseconds) extraction times needed. To address this, we introduce autoresonance to third-order resonant extraction for the first time. With this method, a frequency-swept, low-amplitude excitation efficiently drives the whole beam into resonance, enabling rapid extraction within a single sweep period. This technique only requires adding an octupole magnet, unlike conventional approaches that simply increase excitation amplitude. Conventional RF-KO uses repetitive frequency sweeps, driving individual particles at separate times, while autoresonance RF-KO excites the entire beam simultaneously. We analyze the autoresonance threshold and demonstrate, through simulation, the feasibility of millisecond-scale extraction.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: XIAO, Ding (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **125** Contribution code: **TUIAC03**   Type: **Invited Oral Presentation**

Beam Dynamics and Beam Commissioning Results of the RAON Linear Accelerator

Tuesday, October 21, 2025 9:30 AM (30 minutes)

The RAON linear accelerator consists of a front-end injector and a superconducting linear accelerator (SCL3). The injector includes a 14.5 GHz Electron Cyclotron Resonance (ECR) ion source and a Radio Frequency Quadrupole (RFQ). The ECR ion source can generate a wide range of ion beams, from protons to uranium, with an energy of 10 keV/u. The RFQ accelerates these ion beams up to 500 keV/u. The superconducting linear accelerator, SCL3, is equipped with Quarter Wave Resonators (QWRs) and Half Wave Resonators (HWRs), enabling uranium beams to reach energies of up to 18.5 MeV/u. Beam commissioning of the injector began in August 2021, with tests conducted using argon, neon, oxygen, helium, and proton beams. Commissioning of SCL3 started in October 2022, utilizing argon beams generated by the ECR ion source. This work presents the current status of RAON linear accelerator beam commissioning from a beam dynamics perspective.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: JANG, Ji-Ho (Institute for Basic Science)

Session Classification: TUIAC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **126** Contribution code: **WECBC02** Type: **Contributed Oral Presentation**

Quantifying Differences Between High-Dimensional Beam Phase Space Distributions Using f-Divergences

Wednesday, October 22, 2025 11:50 AM (20 minutes)

Quantifying differences between high-dimensional phase space distributions is essential for analyzing beam measurements and simulations. While f-divergences such as KL or JS divergence are increasingly used for this purpose, including in machine learning applications, their values lack physical interpretability. This work establishes the first physics-grounded framework for f-divergences in accelerator beam contexts. Through systematic analysis of 4D transverse phase space distributions with elliptical symmetry, we reveal how distinct f-divergences assign region-specific weights to distribution cores, tails, and halos. We also prove rigorous correspondences between f-divergence values and conventional beam physics quantities: emittance differences and mismatch factors. These results, validated by statistical analysis of synthetic distributions, provide concrete selection guidelines for f-divergences in phase space comparisons and establish assessment standards for evaluating f-divergence values in beam physics applications.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: DU, Yu (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: WECBC WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **127** Contribution code: **THPT19**   Type: **Poster Presentation**

Design of a laser-based emittance meter for the H- beam at CSNS

Thursday, October 23, 2025 5:10 PM (20 minutes)

After the success of 80 MeV negative hydrogen beam profile measurement based on laser wire monitor, in order to further realize the beam emissivity measurement, an emissivity measurement system combining the laser wire monitor and LGAD (low-Gain Avalanche Diode) sensor is designed in this paper. The main idea is to use the LGAD sensor to reconstruct the H0 distribution, combined with the laser wire profile measurement, to realize the emissivity measurement of the negative hydrogen beam current. In this paper, we will focus on the design of the H0 distribution measurement system based on the LGAD sensor. It mainly includes the characterization of the LGAD sensor by the emissivity source; the evaluation of H0 particle energy deposition; the design of the ceramic PCB board of the LGAD sensor and the response test of the local signal.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZHANG, Biao (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **128** Contribution code: **THPT13**   Type: **Poster Presentation**

Commissioning of an Optical IPM for the CSNS LINAC

Thursday, October 23, 2025 5:10 PM (20 minutes)

A residual gas Ionization Profile Monitor (IPM) was designed and installed in CSNS-Linac for horizontal beam profile measurement. In the design of the IPM, the use of equipotential electrodes was abandoned. Instead, a honeycomb structure is incorporated at the openings of the anode plate to suppress the horizontal component of the electric field. The shadowing introduced by the honeycomb during imaging is corrected using the DIP machine learning model, resulting in a post-correction measurement error of 8.3 %, which meets the measurement requirements for the IPM at the Linac location.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LIU, Mengyu (Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **129** Contribution code: **THFA13**   Type: **Flash Poster Presentation**

Design of the BLM electronics for the CSNS Superconducting LINAC

Thursday, October 23, 2025 2:55 PM (5 minutes)

CSNS-II superconducting Section Beam Loss Measurement Electronic Design

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

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZENG, Lei (Institute of High Energy Physics)

Session Classification: THFA WGs flash talks

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **130** Contribution code: **THCBC03**   Type: **Contributed Oral Presentation**

Laser-assisted H- stripping injection for the CSNS-II RCS

Thursday, October 23, 2025 12:10 PM (20 minutes)

For the high power spallation neutron sources, the laser-assisted H– stripping is a new essential technology. It can be an alternative to the foil stripping which may be used to overcome various difficulties faced by the stripping foils, such as short lifetime, high temperature, large radiation dose, etc. In this paper, based on the phase II of China Spallation Neutron Source (CSNS-II), the laser-assisted H- stripping injection method has been studied in depth. First, the physical principle of laser-assisted H- stripping injection is deeply explored theoretically. The influencing factors of laser and H- beam interaction, Lorentz stripping and other processes are studied. Second, the influences of injection beam parameters on the Lorentz stripping and laser excitation are studied, and the emittance growth of injection beam after stripping is explored. Finally, based on the beam parameters of the CSNS II, the design scheme of the laser-assisted H– stripping injection has been proposed.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: HUANG, Ming-Yang (Institute of High Energy Physics)

Session Classification: THCBC WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **131** Contribution code: **THPT40**   Type: **Poster Presentation**

Maximum entropy tomography in 4D transverse phase space with frozen space charge

Thursday, October 23, 2025 5:10 PM (20 minutes)

Obtaining complete high-dimensional phase space distributions is essential for predicting and controlling intense beam evolution. Building on our prior tomography algorithm that reconstructs four-dimensional (4D) transverse phase space distributions from 2D measurements, applicable under both linear and nonlinear beam transport, this work extends the framework to incorporate frozen space charge effects based on RMS envelope equations. Validated through simulated tomography experiments, this extension significantly enhances reconstruction accuracy for high-intensity beams in comparison with space-charge-free models. The improved algorithm establishes new capabilities for high-fidelity 4D phase space diagnostics in high-current accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LIU, Liwen (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **132** Contribution code: **THCBB02**   Type: **Contributed Oral Presentation**

Status and future of the Beam Gas Curtain: a non-invasive profile and emittance monitor for high-intensity hadron machines.

Thursday, October 23, 2025 12:10 PM (20 minutes)

High-intensity hadron machines host beams with destructive power, and traditional beam profile monitors, such as scintillating screens and wire scanners, suffer a short lifetime under such severe conditions. The application of the beam gas curtain monitor (BGC) in the LHC, along with 2 years of successful operation, fills the gap in such measurements in a minimally invasive manner for high-intensity hadron machines. By using a supersonic gas curtain with a tailored shape and gas density, the monitor satisfies the requirements of vacuum, resolution, and machine protection. In this contribution, the operational experience of BGC in the LHC will be discussed, as well as the development plan in the phase of HLLHC, and the possible halo monitor for hadron machines.

Footnotes

Funding Agency

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Yes

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Presenter: ZHANG, Hao (Cockcroft Institute)

Session Classification: THCBB WGE contributed oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **133** Contribution code: **THPT16**   Type: **Poster Presentation**

Design considerations of the bunch-by-bunch transverse feedback system for the CSNS RCS

Thursday, October 23, 2025 5:10 PM (20 minutes)

The CSNS RCS (Rapid Cycling Synchrotron) is a proton accelerator designed to achieve a target beam energy of 1.6 GeV, with a typical operating intensity of 140 kW, which is expected to increase to 500 kW after the CSNS II upgrade. However, a significant current instability has been observed during the 100 kW beam operation. To mitigate this instability, techniques such as operational tuning and chrominance modulation were previously used to make the 100 kW beam operate stably. In order to face the subsequent stronger instability, a bunch-by-bunch transverse feedback system is required to mitigate the coherent lateral oscillations caused by instability and injection errors. In this paper, the preliminary design of the feedback system will be presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **134** Contribution code: **THFA01**   Type: **Flash Poster Presentation**

Modeling of Long-Bunch Space Charge in Circular Accelerators with Unfixed Closed Orbit

Thursday, October 23, 2025 2:00 PM (5 minutes)

We present PyFFA, a Python-based simulation framework developed for high-intensity beam dynamics studies in circular accelerators with unfixed closed orbits. The code features multi-particle tracking with self-consistent 2.5D Particle-In-Cell (PIC) space charge calculations and supports multi-turn painting injection for long bunches in accelerators such as FFA machines and cyclotrons.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: ZHOU, Kai (Institute of High Energy Physics)

Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **135** Contribution code: **THPT11**   Type: **Poster Presentation**

Broadband capture and achromatic focusing of laser-driven protons for RF linac post-acceleration

Thursday, October 23, 2025 5:10 PM (20 minutes)

Laser-driven proton sources produce ultra-short, high-current pulses ideal for FLASH radiotherapy but lack therapeutic energy levels. Bridging this energy gap via RF linac post-acceleration faces critical beam transport challenges due to wide angular divergence and broad energy spreads intrinsic to laser protons. This work analyzes how large energy spreads constrain RF bunching and capture dynamics, introducing unique trade-offs that determine optimal frequency selection and longitudinal placement. We also developed linear focusing schemes that exploit buncher-generated energy modulation to compensate chromatic aberrations. Beam dynamics simulations for 7 MeV laser protons confirmed simultaneous broadband energy capture and achromatic focusing, achieving >5 times the transport efficiency of previous post-acceleration designs with S-band cavities. These results validated design strategies for laser-RF hybrid proton linacs targeting future high-efficiency medical accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: ZHOU, Haoyu (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **136** Contribution code: **THPT22**   Type: **Poster Presentation**

Design of Differential Beam Current Measurement System for Fast Protection in CSNS-II Linac Upgrade

Thursday, October 23, 2025 5:10 PM (20 minutes)

The upgrade of linac in China Spallation Neutron Source (CSNS-II) requires a robust Differential Beam Current Measurement (DBCM) system to ensure safe operation of superconducting cavities within the Fast Protection System (FPS). This paper presents a practical design for a DBCM system tailored for the chopped-beam operation. The system integrates a Bergoz Fast Current Transformer (FCT) with a 0.5 V/A sensitivity, front-end analog electronics featuring fast-switching OPA680 amplifiers, and a Xilinx Zynq UltraScale+ RFSoC-based FPGA digital board for real-time signal processing. Key features include band-pass filtering , digital droop compensation using an IIR filter to achieve < 0.5% pulse height accuracy, and DC restoration for precise baseline correction. The RFSoC platform supports high-speed ADC sampling (≥ 500 MSa/s), trigger logic for < 200 ns interlock response, and data storage for 10 macro-pulses (~ 6.5 ms). Integrated into a Linux-based EPICS environment, the system ensures reliable, high-precision beam monitoring, meeting CSNS-II's stringent requirements for superconducting cavity protection.

Footnotes

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Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: HUANG, Weiling (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **137** Contribution code: **THPT05**   Type: **Poster Presentation**

Beam Dynamics Design and Beam commissioning of a Compact Accelerator-Based Neutron Source with a double Einzel-Lens LEBT and RFQ

Thursday, October 23, 2025 5:10 PM (20 minutes)

To enable the compact design of an accelerator-driven neutron source, this study developed a beamline scheme that combines a double Einzel-lens focusing system with a compact RFQ accelerator. A double Einzel-lens configuration is employed in the low-energy beam transport section, successfully reducing its length to less than 0.2 m. The accelerator section utilizes a 325 MHz four-vane Radio Frequency Quadrupole(RFQ) with a total length of 2.6 m. Beam dynamics simulations indicate that the RFQ can accelerate a proton beam with a peak current of 12 mA and a 3% duty factor to an energy of 2.5 MeV, achieving a transmission efficiency of 98.8%. In the High-Energy Beam Transport section(HEBT), a quadrupole doublet is used to control the beam spot size at the target.

Beam commissioning was conducted to evaluate the system's performance. By adjusting the voltages of the Einzel lenses, beam focusing was optimized to enhance RFQ transmission. The optimal performance was achieved with lens voltages of 28.7 kV and 27.2 kV, resulting in a beam current of 10.6 mA measured by the ACCT in the HEBT and an experimental transmission efficiency of 93.8%.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: SU, Haoquan (Xi'an Jiaotong University)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **138** Contribution code: **TUIDB01**   Type: **Invited Oral Presentation**

RF system issues to drive the Newgain RFQ without circulators

Tuesday, October 21, 2025 4:00 PM (30 minutes)

A second 4-port RFQ (RFQ2) is being built at GANIL in the framework of the NEWGAIN project, the new injector for the SPIRAL2 SC linac, dedicated to heavier ions. The experience driving RFQ1, the technology evolution on solid state amplifier and the commissioning planning of the new injector let us try to drive the RFQ2 with a simplified RF system based on one LLRF, solid state amplifiers, and no circulators. The paper develops these topics, focusing mainly on the RFQ used as a combiner and on the amplifier issues: oversizing, transistor working point, combiner choice

Footnotes

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Yes

Funding Agency

ANR-21-ESRE-0018

Author: DI GIACOMO, Marco (GANIL)

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Session Classification: TUIDB WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **139** Contribution code: **THPT52**   Type: **Poster Presentation**

Research on a Hybrid Coupled Cavity Accelerating Structure for Low-Energy High-Current Proton Beams

Thursday, October 23, 2025 5:10 PM (20 minutes)

To enhance the accelerating efficiency of the high-current accelerator for a neutron source, a 100-mA, 162.5-MHz, CW compact hybrid accelerating cavity incorporating inductively coupled four-vane RFQ and CH DTL structures is designed. The dynamics design, the RF structure design, and water-cooling design of the hybrid cavity have been accomplished. The proton beam is accelerated from 80 keV to 0.8 MeV via the RFQ and is further accelerated to 3 MeV by the DTL. The coupling modes of the two-resonant-cavity are analyzed with the circuit model. A resonant frequency and field distribution matching scheme based on local frequency adjustments of both the RFQ and DTL sections are presented. The designed length of the hybrid accelerating cavity is 3.94 m, and its total power consumption is 101.3 kW.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: TUO, Mingze (Tsinghua University)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **140** Contribution code: **THIAB03**   Type: **Invited Oral Presentation**

Commissioning and Operation experience of the CSNS Linear accelerator

Thursday, October 23, 2025 9:20 AM (30 minutes)

The China Spallation Neutron Source (CSNS) accelerator complex comprises an 80 MeV H⁻ normal-conducting linear accelerator (linac), a 1.6 GeV rapid cycling synchrotron (RCS), and associated beam transport lines. Following multiple rounds of beam commissioning, the beam power delivered to the target has been successfully increased to 170 kW, surpassing the design value by 70%. Building on this achievement, the power upgrade project (CSNS-II) was launched in 2024, aiming to elevate the beam power to 500 kW. This upgrade presents significant challenges for the linac, requiring a fourfold increase in beam current and a fortyfold increase in beam power. To address these challenges, extensive beam studies have been conducted at the linac. These studies focus on optimizing the lattice and beam matching, precisely measuring beam parameters, refining the computer model, investigating beam loss mechanisms, and implementing strategies to minimize beam loss. These efforts are critical to ensuring the successful realization of the CSNS-II power upgrade.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: PENG, Jun (Institute of High Energy Physics)

Session Classification: THIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **141** Contribution code: **THPT44**   Type: **Poster Presentation**

On Fluid Modelling of Beam Instabilities with Wakefields and Direct Space Charge

Thursday, October 23, 2025 5:10 PM (20 minutes)

In absence of direct space charge, the indirect electromagnetic self-interaction of particle beams via surrounding materials is typically described by wakefields. Beam stability can then readily be assessed in terms of absolute stability of the dipole moment density using linear stability analysis via eigenfunctions, where small density perturbations either decay (stable regime) or exponentially amplify in time and space (unstable regime). Direct space charge is now known to modify these stability conditions by shifting stable parameter regions and providing additional intrinsic Landau damping. Interestingly, direct space charge is observed to add a third type of behaviour with amplified perturbations in space which decay over time (meta-stable regime). Due to the self-consistent nature of the space charge problem in contrast to the pure wakefield problem, this beam behaviour cannot be captured by absolute linear stability analysis. Fluid dynamics can capture this behaviour, with some explanation provided by Burov in PRAB 2019. We review the details of the hydrodynamic model as a basis to investigate mitigation measures.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: OEFTIGER, Adrian (John Adams Institute)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **142** Contribution code: **TUICB02**   Type: **Invited Oral Presentation**

Technical Commissioning of the ESS Accelerator

Tuesday, October 21, 2025 2:00 PM (20 minutes)

The European Spallation Source (ESS) has recently completed beam commissioning up to the tuning beam dump, reaching a proton energy of 800 MeV. This talk will focus on the technical commissioning of the linear accelerator, covering both the normal-conducting and superconducting sections, as well as the testing and integration of superconducting cryomodules. We will describe the phased commissioning process, including high-power RF conditioning of the normal-conducting cavities, superconducting RF (SRF) cavities, and power couplers. Highlights from cryomodule installation, cooldown, and performance testing will be presented. The talk will also discuss integration challenges, cross-functional coordination, and key lessons learned during this phase. Selected results will demonstrate the system's readiness for high-power beam operation and outline the next steps in ESS commissioning.

Footnotes

Funding Agency

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Presenter: NICOSIA, Domenic (European Spallation Source)

Session Classification: TUICB WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **143** Contribution code: **WEIBB03**   Type: **Invited Oral Presentation**

Progress in Slow Extraction Beam Operation at the J-PARC Main Ring

Wednesday, October 22, 2025 12:00 PM (30 minutes)

The J-PARC Main Ring is a 30 GeV proton synchrotron with two extraction modes: fast and slow. The slow extraction is performed using the third-order resonance of betatron oscillations, and the extracted beam is delivered to a variety of particle and nuclear physics experiments at the Hadron Experimental Facility. An upgrade of the Main Ring carried out from 2022 to 2023 significantly shortened the time required to accelerate the beam from 3 GeV to 30 GeV, reducing it from 1.4 seconds to 0.65 seconds. Following the upgrade, slow extraction operation resumed in 2024. Between April and May 2025, beam operation was successfully achieved with a beam power of 92 kW, an extraction efficiency of 99.6%, and a spill duty factor of approximately 80%.

These results were made possible not only by the reduced cycle time due to the upgrade, but also by several key improvements: the activatoin of the second-harmonic RF system to mitigate injection losses and suppress beam instabilities during debunching; the introduction of beam diffusers to reduce beam losses; and improvements of the spill regulation system to enhance spill quality. This presentation will describe these developments in detail.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WEIBB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **144** Contribution code: **TUCDB03**   Type: **Contributed Oral Presentation**

Recent Advances in Enhancing SRF Cavity Performance from IMP: Thermal Management via Inner-Wall AlN Coatings and Mechanism of Medium-Temperature Bake (MTB)

Tuesday, October 21, 2025 5:10 PM (20 minutes)

Enhancing the accelerating gradient and intrinsic quality factor (Q_0) of SRF cavities is critical for next-generation accelerators. This work reports two advances from IMP: (1) Thermal Management with AlN Coatings: To address thermal limitations, this study demonstrates enhanced thermal diffusivity in SRF cavities via inner-wall aluminum nitride (AlN) coatings. Innovative thermal conductivity measurements using perpendicular laser heating (simulating RF dissipation) combined with COMSOL simulations quantitatively reveal the superior dynamic thermal response of AlN-coated Nb substrates. Future work integrates this laser system for optimized testing. (2) Medium-Temperature Bake (MTB) Mechanism: In-situ high-resolution TEM on small samples reveals the MTB process physically enhances SRF performance by decomposing surface oxides. Direct observation confirms oxygen diffusion and associated lattice defect formation during MTB, clarifying its operational pathway. Future research targets defect impacts on RF resistance and MTB protocol optimization. Together, these studies provide methodologies and insights supporting SRF cavity design for future accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenters: LUO, Didi (Institute of Modern Physics, Chinese Academy of Sciences); CHEN, Shantong (Institute of Modern Physics)

Session Classification: TUCDB WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **145** Contribution code: **THPT47**   Type: **Poster Presentation**

Position-phase error cancellation effects in beam-based linac alignment and synchronization

Thursday, October 23, 2025 5:10 PM (20 minutes)

As prerequisites for automatic phase setting and fault compensation, precise longitudinal alignment and RF phase calibration are critical for high-intensity superconducting hadron linacs. While multiple facilities have successfully aligned or synchronized their linacs with time-of-flight (TOF) beam-based methods, existing error analyses typically assume uncorrelated position and phase uncertainties. This work rigorously derives intrinsic correlations between position and phase errors in beam-calibrated linacs. We demonstrate how these correlations can induce error cancellation effects that improve the accuracy of energy measurements and phase setting. Having validated these effects through simulations, we analyzed their implications for beam-based calibration experiments with applications to HIAF and CiADS commissioning.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: ZHOU, Haoyu (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **146** Contribution code: **THPT03**   Type: **Poster Presentation**

Applications of Machine Learning in Beam Commissioning and Operation at CSNS

Thursday, October 23, 2025 5:10 PM (20 minutes)

The integration of machine learning (ML) techniques into beam commissioning and operations at CSNS has shown promising potential for improving beam quality, operational efficiency. This work presents a comprehensive overview of recent ML applications across multiple stages of CSNS operations. A key foundation of these efforts is the development of an AI-ready dataset generation platform, which enables systematic extraction, transformation, and labeling of data from the control system database. Building upon this data infrastructure, intelligent beam commissioning algorithms have been developed and tested. In parallel, ML-based fault detection and early warning systems have been deployed to monitor critical subsystems in real time, enabling timely intervention and reducing unplanned downtime.Looking ahead, preliminary efforts are underway to explore the use of large language models (LLMs) to assist with beam operations, particularly in areas such as automated information retrieval, natural language interaction. Collectively, these applications highlight the transformative potential of AI in modern accelerator facilities.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LU, Xiaohan (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **147** Contribution code: **TUIAC04**   Type: **Invited Oral Presentation**

BEAM DYNAMICS OF A HEAVY-ION LINAC INJECTOR FOR THE XiPAF-UPGRADING SYNCHROTRON

Tuesday, October 21, 2025 10:00 AM (30 minutes)

We present, in this paper, the design result of the beam dynamics for a heavy-ion injection line of the Xi'an 200 MeV Proton Application Facility (XiPAF) upgrading project. The heavy-ion injection line consists of an electron cyclotron resonance (ECR) ion source (IS) system, a low energy beam transport line (LEBT), a four-vane radio frequency quadrupole (RFQ) accelerator, an interdigital H-mode drift tube linac (IH-DTL) with an electromagnetic quadrupole (EMQ) structure, and a linac-to-ring beam transport line (LRBT). The injection line can provide 2 MeV/u heavy-ion beams which will be injected into the synchrotron via multi-turn injection through an electrostatic septum. The characteristics of the injected beam are validated using the TraceWin code to ensure they meet the specifications for transverse emittance, momentum spread, mismatch factor of Twiss parameters, and beam dispersion.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: XING, Q. Z. (Tsinghua University)

Session Classification: TUIAC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **148** Contribution code: **THPT45**

Type: **Poster Presentation**

Online Measurement of Beam Phase and Energy Gain Based on Beam-Cavity Interaction

Thursday, October 23, 2025 5:10 PM (20 minutes)

Online monitoring of beam phase and energy gain within accelerating cavities is crucial for the stable operation of accelerators, especially in high-power scenarios. As cavities are typically calibrated with a low-current, short-pulse beam for safety purposes, the beam behavior may deviate from the calibrated case when running high-current beams, due to strong space charge effects and other possible factors. Motivated by the high-power tendency of accelerator development, methods for online measurement of beam phase and energy gain have been developed, based on the beam–cavity interaction. The methods were validated in both single-cell and multicell cavities, using data acquired during the last beam commissioning at ESS. The consistency among the results obtained from different methods affirmed their reliability. Furthermore, the online testing demonstrated their practical feasibility for real-time application.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **149** Contribution code: **THPT27**   Type: **Poster Presentation**

Efficient Beam Tuning with Surrogate-Model Based Reinforcement Learning

Thursday, October 23, 2025 5:10 PM (20 minutes)

Beam tuning in particle accelerators is a complex task, especially when physical modeling is impractical due to the lack of complete beam diagnostics. Manual, iterative adjustment by operators is time-consuming and often fails to converge rapidly on optimal settings.

We propose a reinforcement learning (RL) approach accelerated by a surrogate model trained on limited online data, enabling efficient exploration of the control parameter space. The surrogate model predicts beam responses with sufficient fidelity to guide the RL agent's policy updates, dramatically reducing the number of real-machine evaluations required. We apply this framework to the High-Intensity Proton Injector (HIPI), demonstrating that the surrogate-assisted RL agent achieves robust beam transmission rates of approximately 90% within minutes of online deployment. This strategy provides a practical for automated beam optimization.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **150** Contribution code: **MOLAA02**   Type: **Plenary Presentation**

ESS Project Update: From Installation to Beam Commissioning

Monday, October 20, 2025 10:00 AM (30 minutes)

The European Spallation Source (ESS) is a multi-disciplinary neutron research facility currently under construction in Lund, Sweden. Its driver is a multi-megawatt proton linear accelerator that pushes the boundaries of technology and physics for high-power, high-intensity, low-loss operation. Once completed, the linac will accelerate a 62.5 mA, 2.86 ms, 14 Hz proton beam up to 2 GeV through a combination of normal-conducting and superconducting cavities. With installation and testing advancing rapidly, the machine is now undergoing an intense, multi-stage commissioning campaign, progressing as more hardware becomes available. This paper summarises recent progress across the accelerator, target, and instruments, with particular emphasis on the latest developments. It also outlines the accelerator roadmap to first beam on target, highlighting key challenges and lessons learned so far.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: MOLAA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **151** Contribution code: **WEIAB01**   Type: **Invited Oral Presentation**

Three Years of SPIRAL2 SC LINAC Operation at GANIL : Challenges and futur

Wednesday, October 22, 2025 8:30 AM (30 minutes)

GANIL (Grand Accélérateur National d'Ions Lourds) started the operation of the SPIRAL2 superconducting linac in 2022. Experiments in the Neutron For Science (NFS) room, specific beam dynamics studies, and various technical improvements are carried out during its operation in the second half of each year, after the run of the cyclotrons in the first half. In 2024, a first period of parallel operation between the linac and the cyclotrons was successfully performed. So far, most experiments in the NFS area have been performed using $\boxtimes^+$ beams, and in some cases with $^4He^{2+}$ and $\boxtimes^+$, at energies ranging from 7 to 33 MeV/A. Linac tunings with $^{18}O^{6+}$ and $^{40}Ar^{14+}$ ion beams, at energies between 5 and 14.5 MeV/A, were also carried out. In 2024, the first milestone was reached for the Super Separator Spectrometer (S^3) experimental area, with the successful delivery of a $^{40}Ar^{14+}$ beam up to the first target station in the room. The paper presents a summary of the beam time distribution during the third year of operation, preliminary results of specific studies on cavity failure recovery, and the future plans of GANIL.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: Dr ORDUZ, Angie (Grand Accélérateur Nat. d'Ions Lourds)

Session Classification: WEIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **152** Contribution code: **WEIAC04**   Type: **Invited Oral Presentation**

Super-resolution Reconstruction Algorithm Applied to the Reconstruction of Electron Beam Transverse Phase Space Based on the Scanning Slit Method

Wednesday, October 22, 2025 10:00 AM (30 minutes)

Electron beam injectors, critical to light sources and ultrafast diffraction systems, need precise transverse phase space diagnostics for optimizing beam quality. The slit-scanning method, often combined with computed tomography (CT), is common for non-presumptive phase space reconstruction but has resolution limits due to sparse sampling and constraints of devices/experimental conditions. This study proposes a deep learning-based super-resolution framework to address these issues. Integrating beam transport physics with neural networks, it effectively recovers phase space details from limited slit-scanning data, overcoming resolution degradation in low-data regimes. Compared with traditional methods, it significantly improves reconstructed transverse phase space resolution, better reflecting electron beam transverse performance. Coupled with beam dynamics simulations, it offers systematic engineering solutions for high-fidelity diagnostics, boosting characterization efficiency and reducing accelerator commissioning costs. This research provides an approach to enhance beam transverse phase space reconstruction accuracy, contributing notably to modern particle accelerator technology.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: WEIAC WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **153** Contribution code: **WEICC01**   Type: **Invited Oral Presentation**

RFQ Beam Dynamics Design Using AI Techniques

Wednesday, October 22, 2025 2:00 PM (30 minutes)

An optimization toolkit named VeRDe (Venetian RFQ Design) has been developed at the Legnaro National Laboratories for the design of Radiofrequency Quadrupoles (RFQs). It builds on well-established RFQ design methodologies and is based on the Los Alamos codes: PARMTEQM, PARI, RFQuick, and CURLI. The toolkit enables detailed control over the evolution of key RFQ cell parameters, like voltage etc...

The RFQ design process, involving many cells (ranging from tens to hundreds), results in a high number of degrees of freedom. While theoretical guidelines help reduce this complexity, final-stage optimization often requires evaluating hundreds to thousands of candidate designs. To address this, VeRDe now incorporates advanced optimization techniques based on evolutionary and swarm intelligence algorithms, specifically: Particle Swarm Optimization (PSO), Improved Stochastic Ranking Evolutionary Strategy (ISRES), Genetic Algorithm (GA), and others. These enhancements aim to significantly accelerate and improve the optimization process.

In this article, a description of the toolkit is presented, along with a comparison between the IFMIF RFQ and a proposed upgrade for the DONES RFQ.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: WEICC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **154** Contribution code: **THPT64** Type: **Poster Presentation**

The slow extraction feedback system at HIRFL-CSR

Thursday, October 23, 2025 5:10 PM (20 minutes)

The slow extraction feedback system is built at HIRFL-CSR, Lanzhou. It is an auto adjusted feedback system based on the predicted value from DCCT at CSRm. The TMIC with the ability of online monitoring spill structure and beam profile is equipped at the terminal. The 10 kHz intensity signal is fed into the electronics of RFKO with a 1 kW power amplifier. The system is operated at July, 2025. In the commissioning, the beam is strongly stable at the initial period is found by the feedback system. By adjusting the sextupole ramping, the duty factor of the spill is increased from 80% to 90%. Further work is discussed with beam dynamic fellows to apply the feedback system sub 1E6 pps.

Footnotes

Funding Agency

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Presenter: LIU, Tong (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **155** Contribution code: **MOLBA03**Type: **Plenary Presentation**

The Muon Collider design challenges

Monday, October 20, 2025 12:00 PM (30 minutes)

The International Muon Collider Collaboration (IMCC) was established following the 2020 Update of the European Strategy for Particle Physics, with the aim of assessing the feasibility of a muon collider operating at a centre-of-mass energy of ˜10 TeV. The concept of colliding beams of oppositely charged muons dates back to the late 1960s, with foundational work by F.F. Tikhonin, G.I. Budker, and A.N. Skrinski. Interest in muon colliders has recently been revitalized due to technological advances that address longstanding obstacles, many of which were first tackled by the Muon Accelerator Program (MAP-US) in the United States (2010–2017) and have since been advanced by the IMCC. The large mass of the muon (207 times that of the electron) suppresses synchrotron radiation, making circular colliders feasible. However, the short muon lifetime (2.2 μs at rest) constrains the number of usable turns, making the design and operation of such a collider uniquely challenging. Despite the many hurdles linked to the muon decay, no fundamental showstopper has been identified to date. A muon collider thus remains a highly promising candidate for the next-generation high-energy physics facility.

Footnotes

Funding Agency

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Session Classification: MOLBA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **156** Contribution code: **THPT36**   Type: **Poster Presentation**

Impedance in matter

Thursday, October 23, 2025 5:10 PM (20 minutes)

The delivery of a high-brightness muon beam through ionisation cooling is essential to produce sufficient luminosity in a muon collider. The ionisation cooling technique has been demonstrated in principle by the Muon Ionisation Cooling Experiment (MICE) but the potential detrimental impacts of collective effects still need to be carefully investigated. Using the same formalism as the one developed two decades ago for the CERN LHC collimators (which revealed a new and beneficial physical regime), the longitudinal and transverse beam coupling impedances in matter have been computed analytically for the case of a cylindrically symmetric material characterised by any electrical conductivity, permittivity and permeability, surrounded by a perfect conductor and with a longitudinal size much larger than the transverse one.

Footnotes

Funding Agency

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Yes

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Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **157** Contribution code: **WECCC02** Type: **Contributed Oral Presentation**

The progress of HIAF Linac and beam commissioning

Wednesday, October 22, 2025 2:30 PM (20 minutes)

The High Intensity Heavy-ion Accelerator Facility (HIAF) will be one of the world's leading heavy-ion accelerators in the near future that enables to explore the unknown territories in nuclear chart, atomic physics research in experiments and heavy-ion applications. This facility is composed of a fully superconducting linear accelerator iLINAC, a fast-cycling synchrotron BRing, and six experimental terminals. The iLINAC is the injector of the HIAF facility and is designed to be the the highest beam intensity superconducting heavy ion linac, which comprises a continuous wave RFQ, a fully superconducting linac (incorporating thirty quarter-wave resonator cavities and in fifty-five half-wave resonator cavities hosting in seventeen cryostats). This talk will introduce the machine research of the iLINAC and beam injection commissioning for the HIAF ring in details.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: CHEN, Weilong (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: WECCC WGB contributed oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **158** Contribution code: **THIBC01**   Type: **Invited Oral Presentation**

RF SISTYEM OF MAGNETIC ALLOY LOADED CAVITY IN CSNS

Thursday, October 23, 2025 11:00 AM (30 minutes)

With the application of in (RCS) of China Spallation Neutron Source(CSNS), space charge effect has been mitigated effectively, the beam power is reaching 170kW with stable operation. However, under high beam power conditions, the strong beam loading effect becomes the primary challenge for the second harmonic RF system. In order to keep system run steadily under complex working conditions, this study constructs a simulation model containing analysis of status of magnetic alloy loaded cavity, power source, Low-Level Radio Frequency con-trol system (LLRF) and RF system of beam based on LTspice platform. In comparison of simulation result and beam commissioning data, the high reliability of the model has been tested. This study provides an important technical tool to optimize RF systems for high-intensity beam operation.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: WU, Bin (Institute of High Energy Physics)

Session Classification: THIBC WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **159** Contribution code: **THPT15**   Type: **Poster Presentation**

Design and Progress of CiADS Beam Line to Reactor

Thursday, October 23, 2025 5:10 PM (20 minutes)

CiADS (China initiative Accelerator Driven sub-critical System) is an experiment facility to demonstrate the ADS concept with high energy proton beam hitting the LBE (Liquid Lead-bismuth Eutectic) target, generating high-flux neutrons to boost the reacotor to transmutate nuclear waste. BLR (Beam Line to Reactor) is one of the key part in CiADS program, which is to transport and match the 2.5 MW beam from superconducting linac to the target inside reactor. BLR needs to meet the requirements both of low beam loss along the beam line and beam density homogenization on the beam window. With special design of beam collimation in phase space, beam loss is limited within 1 W/m along the beam line. By appling multi-order Fourier harmonic superposition scan, beam PCD (Peak Current Density) on the beam window is controlled within 35 μA/cm^2 for 5 mA beam in φ250 mm beam tube. In the presentation, the design, key technology progress and project plan will be introduced.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGC:Accelerator Systems

Contribution ID: **160** Contribution code: **THPT54**   Type: **Poster Presentation**

Research on Optimization of Beam Fault Compensation in CiADS Superconducting Section Based on Reinforcement Learning

Thursday, October 23, 2025 5:10 PM (20 minutes)

High reliability is a major challenge of high-current linear accelerators. This is particularly problematic for Accelerator Driven Systems (ADS) such as the China initiative Accelerator Driven System (CiADS). In order to achieve rapid beam recovery, it is necessary to adjust and compensate the superconducting solenoids and cavities adjacent to the failed components in superconducting linear accelerators. In this study, we employ the Soft Actor-Critic (SAC) algorithm, a reinforcement learning technique, to train a compensation model within a simulated environment of the CiADS superconducting section. Compared to previous methods utilizing genetic algorithms, the reinforcement learning approach demonstrates superior performance in delivering more stable and consistent results for beam dynamics control.

Footnotes

Funding Agency

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Presenter: WANG, Tielong (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **161** Contribution code: **THPT30**   Type: **Poster Presentation**

Fault Tree Modeling and Reliability Analysis of the CAFE2 Accelerator

Thursday, October 23, 2025 5:10 PM (20 minutes)

The China Accelerator Facility for superheavy Elements (CAFE2) stands as a world-leading dedicated facility for superheavy element synthesis research, boasting the highest beam intensity among international counterparts of its kind. It provides advanced experimental conditions for synthesizing new superheavy elements, investigating their chemical properties, and generating neutron-rich superheavy nuclides via multinucleon transfer reactions, thereby safeguarding China's competitive edge in the global arena of superheavy element synthesis.There presents the systematic composition of the CAFE2 accelerator and elaborates on the reliability modeling conducted at the system, subsystem, and equipment levels using fault tree analysis, aiming to identify and categorize various events that may lead to accelerator downtime. Additionally, it outlines future plans for reliability research, offering insights into the ongoing efforts to enhance the facility's operational stability and performance.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **162** Contribution code: **THPT58**   Type: **Poster Presentation**

Study on Resonance and Instability in High-Intensity Beams Based on Envelope Oscillation Theory and Optimization of Beam Transport

Thursday, October 23, 2025 5:10 PM (20 minutes)

In high-intensity beam transport systems, the interaction between resonance and instability significantly impacts beam quality and transmission efficiency. This study aims to investigate the intrinsic link between resonance excitation and instability growth in mismatched high-intensity beams propagating through periodic focusing channels.

Based on envelope oscillation theory, this paper proposes and implements an improved numerical method to accurately capture the generation and evolution of instabilities under various resonance conditions. Through systematic parameter space scanning, regions dominated by specific resonance modes are identified, and optimization strategies are proposed to mitigate their adverse effects, thereby enabling more stable and efficient beam transport.

The proposed approach not only deepens the physical understanding of the coupling mechanism between resonance and instability but also provides a viable technical pathway for optimizing beam matching and lattice design. Future work will extend this method to more complex multidimensional models and incorporate experimental validation to bridge theoretical predictions with engineering applications.

Footnotes

Funding Agency

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Presenter: ZHANG, Tao (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **163** Contribution code: **WEIBC01**   Type: **Invited Oral Presentation**

Beam halo losses reduction with simulation constrained Bayesian Optimization

Wednesday, October 22, 2025 11:00 AM (30 minutes)

The Linear IFMIF Prototype Accelerator (LIPAc) aims to demonstrate CW acceleration of a 125 mA deuteron beam up to 9 MeV using an RFQ and SRF linac. Before SRF linac installation, the beam commissioning was conducted with a 5 MeV deuteron beam. Attempts to increase the duty cycle revealed a significant pressure rise detected by sensors, presumably caused by beam halo, which had previously limited operation to ˜3%. To address this limitation, a Bayesian optimization was applied to the beam optics (four quads and steerers), aiming to minimize halo-induced losses by monitoring vacuum pressure while constraining core losses. The algorithm successfully decreased the sector vacuum pressure by about 67%. Simulations also confirmed that halo formation from space-charge forces was mitigated by relaxing beam focusing in specific regions consistent with theoretical predictions of beam physics. This enabled stable operation up to 8.7% duty cycle. These results demonstrate that machine learning can effectively support optics tuning even in high-current accelerators. This talk presents beam optics before and after the optimization process and the resulting improvements in halo minimization.

Footnotes

Funding Agency

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Presenter: HYUN, Jibong (National Institutes for Quantum Science and Technology)

Session Classification: WEIBC WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **164** Contribution code: **WEIBB01**   Type: **Invited Oral Presentation**

Operational Experience During Commissioning of ESS

Wednesday, October 22, 2025 11:00 AM (30 minutes)

The European Spallation Source (ESS) is a neutron research facility based in Lund, Sweden. Its linear accelerator will operate with a high peak current of 62.5 mA and a long pulse length of 2.86 ms at a repetition rate of 14 Hz, enabling it to deliver 2 MW of beam power to the target. In the first half of 2025, accelerator commissioning was completed with the achievement of a beam energy exceeding 870 MeV, establishing ESS as a 2 MW-capable installation. For the first time, the entire linac was operated using both normal-conducting and superconducting cavities. The operational challenges during commissioning included coordinating installation and work activities, daily planning, and maintaining beam delivery to the tuning beam dump for the studies planned in this phase. In addition to these challenges, this contribution will present an overview of major operational incidents that impacted the commissioning timeline.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: WEIBB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **165** Contribution code: **THPT23**   Type: **Poster Presentation**

Development and Commissioning of the Fast Beam Loss Monitor System at HIAF

Thursday, October 23, 2025 5:10 PM (20 minutes)

The Beam Loss Monitor (BLM) system for the High-Intensity heavy-ion Accelerator Facility (HIAF) has been constructed and deployed. This system features ultra-fast response (≤20 μs, measured down to 4.5 μs) and employs 196 plastic scintillator detectors coupled to photomultiplier tubes (PMTs), strategically positioned in critical areas. It achieves a wide dynamic range of 6 orders of magnitude, enabling pulse counting mode for detecting very weak losses (down to μSv/h levels) and integration mode with threshold alarming for high loss rates. Commissioning of the BLM system with HIAF beam is scheduled for Q4 2025. Its performance, including fast response, sensitivity to weak losses, and reliability as a Machine Protection System (MPS) interlock device, has been successfully validated using high-power (100 kW) proton beams at the ADS-linac facility. Future work focuses on developing adaptive feedback algorithms utilizing real-time beam loss rate data from the BLM and Beam Charge Monitor (BCM) systems, aiming for closed-loop control to enhance beam loss suppression capabilities under complex operational scenarios.

Footnotes

Funding Agency

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Presenter: JING, Long (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **166** Contribution code: **THPT31**   Type: **Poster Presentation**

Grided RF Gun Design

Thursday, October 23, 2025 5:10 PM (20 minutes)

This paper presents a thermionic cathode electron gun with a compact structure for generating continuous-wave electron beams by introducing 650MHz microwave power into the cathode-grid assembly.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Session Classification: THPT poster session

Track Classification: WGC:Accelerator Systems

Contribution ID: **167** Contribution code: **THPT07**   Type: **Poster Presentation**

Beam dynamics design of the superconductiong section of a 100 mA superconducting linac

Thursday, October 23, 2025 5:10 PM (20 minutes)

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

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: Ms YI, Man (Lanzhou University)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **168** Contribution code: **THPT01**   Type: **Poster Presentation**

A beam line design of transverse beam profile uniformization using octupole magnets

Thursday, October 23, 2025 5:10 PM (20 minutes)

The rational use of multipole magnets in a beam line is an effective method of transverse beam profile uniformization. This paper introduces an octupole magnet uniformization design of an about 2.1 MeV proton beam accelerated by a RFQ accelerator and the design is based on TraceWin. This design contains two octupole magnets, which are dedicated to uniformization of x and y directions respectively. To prevent the beam from colliding with the drift tube after passing octupole magnets, a quadrupole magnet is placed in front of each octupole magnet to adjust Twiss parameter α to nearly 0. In the phase advance matching section, the length of the beam line for a 30cmx30cm beam spot size is reduced by increasing phase advance π without changing the strength of octupole magnets. The final uniformization effect on the target surface is measured on the distance from the measured point to the beam center in x and y directions respectively.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Mr WANG, Haoye (Institute of Modern Physics)

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Presenter: Mr WANG, Haoye (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **169** Contribution code: **THPT70**   Type: **Poster Presentation**

Upgraded Design of the IMP High-Current Continuous-Wave Compact SRF Electron Linac

Thursday, October 23, 2025 5:10 PM (20 minutes)

The Institute of Modern Physics (IMP) has independently developed a conduction-cooled superconducting electron linac prototype without liquid helium. The prototype, based on a 650 MHz ($\beta = 0.82$) SRF cavity, successfully accelerated 200 mA, 60 keV, 2 µs pulsed beam to 4.6 MeV with stable operation, demonstrating the feasibility of high-current acceleration.

Building on this achievement, an upgraded design targeting stable continuous-wave (CW) acceleration at 10 mA average beam current has been completed and entered the construction phase. The design maintains a compact layout and low system complexity while addressing the key technical challenges of high thermal load management, RF stability, and beam loss control in CW high-Current operation. Simulation and optimization using TraceWin and AVAS confirm the capability of the upgraded system to deliver reliable high-Current beams for industrial irradiation applications. This work provides a practical compact SRF e-linac solution tailored for CW, high-power operation in demanding industrial environments.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Authors: CHU, Yimeng (Institute of Modern Physics, Chinese Academy of Sciences); WANG, Zhijun (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: CHU, Yimeng (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGC:Accelerator Systems

Contribution ID: **170** Contribution code: **THPT20**   Type: **Poster Presentation**

162.5MHz SINGLE-BUNCH SELECTION ULTRA-FAST BIPOLAR CHOPPER POWER SUPPLY DESIGN

Thursday, October 23, 2025 5:10 PM (20 minutes)

Neutron energy spectrum measurement imposes requirements for single-bunch selection and acceleration on the CiADS (China Initiative Accelerator Driven System) superconducting linear accelerator, which operates at a fundamental frequency of 162.5 MHz. Existing chopper power supplies have rise/fall times approaching 20 ns, making them unable to achieve the required 6.15ns bunch selection via a stable field-free region. To address this, an ultrafast bipolar high-voltage pulse power supply with fixed voltage slope control has been designed. This design loads linearly varying ± 4 kV voltages (slope $\geq$ 180 V/ns) onto the chopper's deflection plates to achieve transverse bunch scanning. The physical aperture restriction at the RFQ (Radio Frequency Quadrupole) entrance is utilized to convert this transverse scan into a time selection window, enabling nanosecond-precision beam bunch selection. This power supply provides crucial technical support for single-bunch selection in the RFQ accelerator. This paper elaborates on the design scheme of the chopper power supply and presents relevant circuit simulation analysis.

Footnotes

Funding Agency

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Yes

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Presenter: QIAO, Xin (Institute of Modern Physics)

Session Classification: THPT poster session

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **171** Contribution code: **THCAC02**   Type: **Contributed Oral Presentation**

Intense highly charged Ion beam production and the status of FECR

Thursday, October 23, 2025 10:20 AM (20 minutes)

The world's first Nb3Sn and NbTi superconducting electron cyclotron resonance (ECR) ion source, FCER (First 4th-generation ECR ion source), has been deployed in the LEAF (Low Energy high-intensity heavy ion Accelerator Facility) project in 2024. Following initial tuning, under 28+45 GHz microwave heating, the FCER successfully produced 350 eμA of Bi35+ and 620 eμA of Bi31+ ion beams. Recently, to further enhance the performance of the FCER, a 32.9 GHz microwave system was installed to replace the original 28 GHz system. As a result, a series of intense Xe and Bi ion beams were generated under high microwave power conditions. These results indicate that increasing the microwave frequency significantly improves the performance of the ion source. In the future, the FCER will aim to produce high-current, highly charged ion beams at the mA level.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LI, Lixuan (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THCAC WGC contributed oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **172** Contribution code: **WEIAC03**　　　Type: **Invited Oral Presentation**

High Power Beam Imaging for Machine Protection

Wednesday, October 22, 2025 9:30 AM (30 minutes)

Optical imaging systems have been designed and installed upstream of the European Spallation Source (ESS) Tuning Dump (TD) and the ESS spallation Target to provide machine protection and beam tuning support functionalities. The ESS accelerator delivers a high-power, low-emittance proton beam, which must always be controlled. In the TD, the optical imaging systems remotely view the beam profile using light from a luminescent chromia alumina ceramic screen. The images of the beam 2D profiles are real-time processed to detect any potential beam properties that can lead to damage to the machine components. This paper reports on the commissioning of the imaging instrument during the ESS linac commissioning period. Studies of the system shows its performance, assuring a robust protection function. The system sensitivity allow detection of very first beam on TD, and a carefully chosen light attenuation system permits operation over 7 orders of magnitude, mapping the TD beam properties from 5µs - 1mA pulse to 3ms - 65mA.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: THOMAS, Cyrille (European Spallation Source)

Session Classification: WEIAC WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **173** Contribution code: **MOLAA01**　　　　Type: **Plenary Presentation**

Exploring the Frontiers of Nuclear Physics with High-Intensity Ion Beams

Monday, October 20, 2025 9:30 AM (30 minutes)

Frontiers in nuclear physics and nuclear astrophysics center on understanding nuclei far from stability, the limits of nuclear matter, and the nuclear reactions that power stellar evolution and explosive phenomena across the Universe. Progress in these fields increasingly relies on high-intensity ion beams, which make it possible to measure extremely small cross sections and study rare isotopes that were previously inaccessible. This talk will highlight how emerging high-intensity beam facilities in China, such as JUNA, LEAF, CAFE, HIAF and CiADS, are opening unprecedented opportunities to directly measure key stellar reaction rates and to advance the frontiers of nuclear physics and nuclear astrophysics.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Prof. TANG, XIAODONG (Institute of Modern Physics)

Presenter: Prof. TANG, XIAODONG (Institute of Modern Physics)

Session Classification: MOLAA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **175** Contribution code: **THIAB01**   Type: **Invited Oral Presentation**

Recent beam study results and strategy for 1.3 MW operation in J-PARC MR

Thursday, October 23, 2025 8:30 AM (30 minutes)

The main ring synchrotron (MR) of Japan Proton Accelerator Research Complex (J-PARC) provides high power proton beams for the neutrino and hadron experiments with fast extraction (FX) and slow extraction (SX), respectively. We have achieved FX 830 kW continuous operation and demonstrated FX 955 kW equivalent beams. We are aiming at FX 1.3 MW operation by 2028. In this talk, we will present the recent beam study results realizing FX 955 kW equivalent beams and strategies toward FX 1.3 MW operation.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **176** Contribution code: **TUICB03**   Type: **Invited Oral Presentation**

Cryomodule developments for proton and heavy-ion linacs at IMP

Tuesday, October 21, 2025 2:20 PM (30 minutes)

The QWR/HWR/Elliptical cavity cryomodules have been developed for proton and heavy-ion linacs at the Institute of Modern Physics (IMP) of the Chinese Academy of Science (CAS). In this paper, the development situation of the cryomodules for IMP has been reported. The application of some specific design effectively improves the commissioning performance of the cryomodule. These cryomodules are being installed in parallel across multiple lines in the assembly hall currently. And the first cryomodule for heavy-ion linacs has completed horizontal testing in July 2024 of HIAF(High Intensity heavy-ion Accelerator Facility) project. This paper will report the design, assembling and commissioning of these cryomodules.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: BAI, Feng (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: TUICB WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **177** Contribution code: **TUICC01**   Type: **Invited Oral Presentation**

First Beam Through the Superconducting Linac of ESS

Tuesday, October 21, 2025 1:30 PM (30 minutes)

The European Spallation Source in Lund, Sweden, is a facility under the final stages of its commissioning process, with the first user program planned in 2027. The 600 m long proton linac underwent beam commissioning in Spring 2025 with first beams through the superconducting part of the accelerator and to the tuning beam dump. This last commissioning run aimed to test all the critical linac components and establish their operations, as well as to establish a stable beam with the final energy larger than 800 MeV at a low beam intensity and short pulse length. These were achieved, and a low-power beam of 6 mA and 5 μs pulse length was successfully accelerated to 810 MeV. Basic tuning schemes, such as phase scans, for setting cavity amplitudes and phases, and beam steering, were also successfully tested. This paper will give an overview of the results from this commissioning phase and the challenges ahead for the initial operations.

Footnotes

Funding Agency

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Presenter: JOHANNESSON, Sofia (European Spallation Source)

Session Classification: TUICC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **178** Contribution code: **FRIAA01**   Type: **Invited Oral Presentation**

Advancing Materials Studies for High-Power Proton Accelerators in J-PARC and Relevant Activities under RaDIATE Collaboration

Friday, October 24, 2025 8:30 AM (30 minutes)

In modern proton accelerators, the survivability of beam-intercepting devices, such as targets, beam windows and beam dumps, under intense beam irradiation is a key factor limiting the achievement of higher beam power. To address this global challenge, Radiation Damage in Accelerator Target Environments (RaDIATE) collaboration was established, with Fermilab acting as the leading institution. J-PARC joined the collaboration in 2017 and has contributed to its research efforts. This presentation will introduce the activities to tackle the studies and relevant activities under the RaDIATE collaboration to date, as well as their future plans.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: FRIAA WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **179** Contribution code: **THPT38**   Type: **Poster Presentation**

Ion Source System: Maximum Extracted Oxygen Beam Current and Emittance Boundary Measurement

Thursday, October 23, 2025 5:10 PM (20 minutes)

To meet the stringent requirements of the downstream superconducting accelerating section for beam matching conditions and intensity specifications, it is necessary to maximize the beam intensity while maintaining the transverse emittance performance at the exit of the normal-conducting front-end. Systematic measurements were conducted of the emittance at the exit of the Low Energy Beam Transport (LEBT) line, the emittance at the exit of the Radio Frequency Quadrupole (RFQ) accelerator, as well as the overall transmission and acceleration efficiency of the front-end. Through quantitative analysis of these parameters under varying beam intensities, we aim to identify the maximum achievable beam intensity that satisfies the emittance constraints. A visualization-based approach is employed to assist in selecting the beam intensity with optimal overall performance.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: BAO, YUNHUI (Institute of Modern Physics, Chinese Academy of Sciences; University of Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **180** Contribution code: **FRIAA02**   Type: **Invited Oral Presentation**

Automation for CERN's accelerator fleet - status and next steps

Friday, October 24, 2025 9:00 AM (30 minutes)

Growing demands on accelerator performance, together with recent advances in computational sciences, provide a remarkable opportunity to rethink how CERN's accelerator complex is operated. Moving beyond traditional approaches, greater automation and improved optimisation methods promise measurable benefits, including reduced costs and energy use, shorter setup times, consistent beam quality, and higher overall reliability. Delivering these gains requires, among others, new algorithms, ranging from classical optimisation to machine learning, and infrastructure that evolves to meet new requirements. Applications extend beyond beam quality optimisation to include equipment-related tasks such as automated setup and recovery, fault prediction and diagnostics, and predictive maintenance. First use cases already support optimisation tasks in daily operation, while further developments are underway. This contribution will review the current status and outline the path toward wider operational use, with emphasis on the Efficient Particle Accelerators (EPA) project as the framework that links these activities into a coherent roadmap from studies to deployment and toward future facilities.

Footnotes

Funding Agency

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Yes

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Markus (European Organization for Nuclear Research); HOSTETTLER, Michi (European Organization for Nuclear Research); ALEMANY-FERNANDEZ, Reyes (European Organization for Nuclear Research); GORBONOSOV, Roman (European Organization for Nuclear Research); KAIN, Verena (European Organization for Nuclear Research)

Presenter: SCHENK, Michael (European Organization for Nuclear Research)

Session Classification: FRIAA WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **181** Contribution code: **MOLCA03**　　　Type: **Plenary Presentation**

The Challenges of Instabilities and Impedances on High Intensity Hadron Machines

Monday, October 20, 2025 3:00 PM (30 minutes)

High-intensity hadron machines stand at the forefront of applied and fundamental research. Pulsed spallation neutron sources harness intense proton beams to drive advances in fields ranging from quantum materials to cultural heritage. Meanwhile, high-energy particle physics colliders are revolutionizing our understanding of the universe's structure. The performance of these accelerators has improved by at least three orders of magnitude since the 1980s, which has been made possible by innovations in mitigating the effects of coherent beam instabilities. Today, these innovations have become fundamental to the design and operation of high intensity hadron accelerators.

This talk will survey some principal tools and techniques: impedance optimisation, chromatic control, Landau damping, feedback systems and optical techniques; illustrate their application today, and reflect on their possible limits for next-generation facilities. A case study from the ISIS Neutron and Muon Source will be presented, where recently discovered transverse resonator impedances on this 40-year-old machine have been found to have implications for some of the most recently constructed RCS accelerators.

Footnotes

Funding Agency

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Yes

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Presenter: POSTHUMA DE BOER, David (ISIS Neutron and Muon Source)

Session Classification: MOLCA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **182** Contribution code: **THPT62**   Type: **Poster Presentation**

The Field Measurement of the Injection Painting Bump Magnets for the CSNS-II/RCS

Thursday, October 23, 2025 5:10 PM (20 minutes)

For accumulating high-intensity beam, the H- stripping injection is adopted in the rapid cycling synchrotron (RCS) of the China Spallation Neutron Source (CSNS). For the CSNS-II, the painting injection is a key solution, which is performed in a straight section of RCS by the bump magnets, including four BCH magnets for horizontal painting, four BV magnets for the vertical painting and one LRBD magnet for the horizontal sweeping compensation. The fabrication and the field measurement of the magnets have been completed. The measurement items include magnetic field response error, magnetic field uniformity, leakage field, and so on. The measurement system and the results of the magnetic field measurement are presented in this paper.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: PANG, Zixi (Institute of High Energy Physics)

Session Classification: THPT poster session

Track Classification: WGC:Accelerator Systems

Contribution ID: **183** Contribution code: **THPT12**   Type: **Poster Presentation**

Calibration of MEBT Buncher Cavity Voltage and Validation of Phase-Sweep Fitting Method via Time-of-Flight Measurement

Thursday, October 23, 2025 5:10 PM (20 minutes)

Accurate setting and readback of radio frequency (RF) cavity voltage is critical for precise beam control in accelerator systems. To address potential discrepancies between set and actual voltages, this study presents an in-situ calibration of the MEBT Buncher1 cavity using a Time-of-Flight (ToF) method. The phase of the cavity was systematically swept while measuring the resulting energy change of a 16O6+ beam via two downstream beam position monitors (BPMs) and a high-speed oscilloscope. A least-squares fitting algorithm was applied to the phase-ToF curves acquired at three distinct nominal cavity voltage settings to determine the actual accelerating voltage and validate the phase-scan-based tuning procedure. The results provide a corrected calibration factor for the low-level RF system, ensuring more reliable beam tuning and future commissioning stages. This method highlights the importance of direct beam-based measurements for accelerator diagnostics and performance optimization.

Footnotes

Funding Agency

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Yes

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Presenter: XUE, Shengzhuo (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGD:Operations and Commissioning

Contribution ID: **184** Contribution code: **TUIBB02**   Type: **Invited Oral Presentation**

Coherent Stability Considerations for High-Intensity Beam Production at FAIR

Tuesday, October 21, 2025 11:30 AM (30 minutes)

The SIS100 synchrotron and its booster SIS18 synchrotron will produce high-intensity heavy-ion beams at the space-charge limit. The transverse collective instabilities can endanger the safe operation, the single-bunch and the coupled-bunch instabilities with non-rigid oscillations are anticipated. As the major means for the instability suppression, the octupole magnets for Landau damping will be used. This can lead to additional beam loss due to nonlinearities and space-charge induced resonance crossing. The machine protection, especially for the superconducting SIS100 main magnets, demands a low-loss (a few percent) operation. Especially the 1 sec beam accumulation at the injection energy in SIS100 can become a bottleneck for the safe operation. We review the expected transverse instabilities and the octupole usage for Landau damping. The effect of space-charge for the required octupole strength is included. The particle tracking simulations and a machine learning based algorithm are used in order to find opmimized octupole configurations.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: KORNILOV, Vladimir (GSI Helmholtz Centre for Heavy Ion Research)

Session Classification: TUIBB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **185** Contribution code: **TUIAB04**   Type: **Invited Oral Presentation**

Recent Developments of the TRIUMF 520 MeV Cyclotron in Support of High-Intensity Operation

Tuesday, October 21, 2025 10:00 AM (30 minutes)

The TRIUMF 520 MeV cyclotron continues to serve as a reliable driver for high-intensity proton beams, supporting a broad range of applications. To sustain and enhance high intensity operation, recent developments have focused on reducing beam losses and improving overall reliability. This talk will highlight progress in several key areas: upgrades to the new injection beamlines; cyclotron tune optimization and the avoidance of linear coupling resonances to suppress beam spills and reduce component activation; and the implementation of a refined degaussing procedure for the main magnet to improve reproducibility and ensure accurate restoration of the isochronous field. In addition to reporting on this progress, the talk will also present some of the ongoing technical and institutional challenges, including beam matching with full 6D coupling through the inflector, nonlinear resonance study, and the broader issue of sustaining expertise around mature accelerator facilities.

Footnotes

Funding Agency

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Yes

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Presenter: ZHANG, lige (TRIUMF)

Session Classification: TUIAB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **186** Contribution code: **TUIDC05**   Type: **Invited Oral Presentation**

Beam Loading in the Superconducting Cavities at the European Spallation Source Linac

Tuesday, October 21, 2025 6:00 PM (30 minutes)

During the commissioning of the ESS LINAC in early summer 2025, we recorded beam-loading transients from a 5 μs, 5 mA beam in 47 superconducting cavities: 26 Spoke and 21 Elliptical Medium Beta. We compare the beam-induced cavity voltage and current phasors with a standard beam-loaded cavity model that includes coupling, loaded Q, and detuning, thereby validating model parameters across the installed sections. Leveraging this agreement, we invert the measured response to compute the beam's synchronous phase on a cavity-by-cavity basis without external timing references. The inferred phase is then used to set the optimal accelerating phase and to quantify residual phase errors and detuning during routine operation. We report sensitivity to measurement noise, pulse-to-pulse reproducibility, and the robustness of the method over the commissioning dataset, and we outline a practical procedure to commission and periodically retune SRF sections at ESS using beam-loading observables alone.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: LAFACE, Emanuele (European Spallation Source)

Session Classification: TUIDC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **187** Contribution code: **WEICB02**   Type: **Invited Oral Presentation**

A test facility of plasma-based acceleration at lHEP

Wednesday, October 22, 2025 2:30 PM (30 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: WEICB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **188** Contribution code: **TUIAB01**   Type: **Invited Oral Presentation**

Advanced Cooling Concepts

Tuesday, October 21, 2025 8:30 AM (30 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: TUIAB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings

Contribution ID: **189** Contribution code: **TUIAC02**   Type: **Invited Oral Presentation**

Beam dynamics comparison of different structures towards a Compact Accelerator Based Neutron Source

Tuesday, October 21, 2025 9:00 AM (30 minutes)

A prototype Canadian compact accelerator-driven neutron source (PC-CANS) is proposed. The source will utilize a high-intensity compact proton RF linear accelerator, delivering a peak current of 20 mA with a 5% duty factor of protons at 10 MeV to the target. The accelerator comprises a short radio-frequency quadrupole (RFQ) to 3 MeV, followed by a drift tube Linac (DTL) structure accelerating to 10 MeV. Various room temperature DTL variants, including Alvarez, and H-mode variants using APF, KONUS, and NPS (negative synchronous phase) beam dynamics are considered at a frequency of 352.2MHz. This paper compares the beam dynamics of the various structures. Comparisons include beam transmission, longitudinal and transverse emittance growth, Linac length, RF power and longitudinal and transverse phase acceptance. Beam dynamics simulations were conducted using the PARMTEQ, LANA, PARMILA, and Trace-3D codes. This work contributes to the development of high power proton linacs by providing a comparison in performance over several Linac structures.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

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Presenter: LAXDAL, Robert (TRIUMF)

Session Classification: TUIAC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **190** Contribution code: **TUIAC01**   Type: **Invited Oral Presentation**

Beam dynamics challenge for multi-charge beam acceleration in FRIB

Tuesday, October 21, 2025 8:30 AM (30 minutes)

Charge stripping is a highly beneficial technique in a heavy ion accelerator to improve acceleration efficiency. However, the beam after the stripping is distributed over several charge states, which leads to low stripping efficiency.

The driver linac of the Facility for Rare Isotope Beams (FRIB) at Michigan State University is designed to simultaneously accelerate multi-charge states of a heavy ion beam to overcome the low efficiency. For instance, the stripping efficiency is improved nearly four times by accelerating five charge states. In addition, two charge states acceleration to the stripper will be enabled by front-end upgrade.

In this presentation, beam dynamics for simultaneous multi-charge state beam acceleration in FRIB is discussed.

Footnotes

I have read and accept the Privacy Policy Statement

Yes

Funding Agency

Author: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

Co-authors: FUKUSHIMA, Kei (Facility for Rare Isotope Beams); GONZALEZ, Alec (Facility for Rare Isotope Beams); HWANG, Kilean (Facility for Rare Isotope Beams); OSTROUMOV, Peter (Facility for Rare Isotope Beams); PLASTUN, Alexander (Facility for Rare Isotope Beams); ZHANG, Tong (Facility for Rare Isotope Beams); ZHAO, Qiang (Michigan State University)

Presenter: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

Session Classification: TUIAC WGB invited oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **191** Contribution code: **WECDC03** Type: **Contributed Oral Presentation**

Exploring the Potential of H_3^+ for High-Intensity Applications

Wednesday, October 22, 2025 5:40 PM (20 minutes)

The use of H_3^+ (triatomic hydrogen ions) presents a promising alternative to the more conventional H^- ions in high power proton accelerators. In this work, we examine the advantages of H_3^+ beams with respect to extraction efficiency, Lorentz dissociation, and space charge limits. The physical properties of H_3^+ enable it to overcome the injection/extraction energy and intensity limits, while still supporting charge exchange based injection and extraction with minimal beam loss. To further illustrate its potential, a conceptual design of a superconducting H_3^+ cyclotron is briefly presented, demonstrating both its technical feasibility and performance advantages.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: ZHANG, lige (TRIUMF)

Co-authors: KOAY, Hui Wen (TRIUMF); JUNG, Paul (TRIUMF); PLANCHE, Thomas (TRIUMF); RAO, Yi-Nong (TRIUMF)

Presenter: ZHANG, lige (TRIUMF)

Session Classification: WECDC WGB contribute oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **193** Contribution code: **FRCAA03**   Type: **Contributed Oral Presentation**

TEST2

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: WANG, Zhijun (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: WANG, Zhijun (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: FRCAA WGE contributed oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **194** Contribution code: **THPT85**   Type: **Contributed Oral Presentation**

ICONE : insights from the early stages of the compact neutron source accelerator

Thursday, October 23, 2025 5:10 PM (20 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: DUMAS, Jonathan (Commissariat à l'Energie Atomique)

Presenter: DUMAS, Jonathan (Commissariat à l'Energie Atomique)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **195** Contribution code: **WECDC02** Type: **Contributed Oral Presentation**

DONES Accelerator Design and Beam Physics

Wednesday, October 22, 2025 5:20 PM (20 minutes)

The IFMIF-DONES facility aims to generate a high flux of 14 MeV neutrons (up to 10^{18} n m^{-2} s^{-1}) to enable the characterization and qualification of materials for future fusion reactors. To accomplish this, it will use a continuous-wave (CW) linear accelerator delivering a 125 mA deuteron beam at 40 MeV onto a liquid lithium target. This configuration presents a unique challenge, combining unprecedented beam intensity, high beam power (5 MW), and strong space-charge effects.

This paper presents the beam physics concepts and methodologies developed for the design and simulations of the DONES accelerator. The simulation results, including start-to-end modeling, are presented and discussed in detail.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: CHAUVIN, Nicolas (Commissariat à l'Énergie Atomique et aux Énergies Alternatives)

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Presenter: CHAUVIN, Nicolas (Commissariat à l'Énergie Atomique et aux Énergies Alternatives)

Session Classification: WECDC WGB contribute oral

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **196** Contribution code: **TUICB04**   Type: **Invited Oral Presentation**

FRIB operations and key accelerator systems

Tuesday, October 21, 2025 2:50 PM (30 minutes)

The Facility for Rare Isotope Beams (FRIB) at Michigan State University is a heavy ion accelerator facility for nuclear science. Since starting scientific user operations in May 2022, the beam power of the driver linac has been gradually increased to 20 kW. A dozen of ion beams from Oxygen to Uranium has been routinely provided to the production target. In this presentation, the systems supporting the linac operation including beam instrumentation, cryogenic system and superconducting technology, and also the experience of recent beam operations will be discussed.

Footnotes

I have read and accept the Privacy Policy Statement

Yes

Funding Agency

Author: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

Presenter: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

Session Classification: TUICB WGC invited oral

Track Classification: WGC:Accelerator Systems

Contribution ID: **197** Contribution code: **WEIBB02**   Type: **Invited Oral Presentation**

Experience with the CERN LINAC4 and its performance during the first four years of operation

Wednesday, October 22, 2025 11:30 AM (30 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: SKOWRONSKI, Piotr (European Organization for Nuclear Research)

Presenter: SKOWRONSKI, Piotr (European Organization for Nuclear Research)

Session Classification: WEIBB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **198** Contribution code: **WEIAB02**   Type: **Invited Oral Presentation**

The first steps in FAIR commissioning

Wednesday, October 22, 2025 9:00 AM (30 minutes)

The international Facility for Antiproton and Ion Research (FAIR) is being built at the GSI Helmholtz Centre in Darmstadt. The first project stage includes the superconducting 100 Tm heavy ion synchrotron SIS100, the Super Fragment Separator, and associated beam transport lines. The GSI's ion sources, UNILAC and SIS18 will provide the beams. Installation work in the FAIR accelerator tunnels and supply buildings started 2024. The sub-project FAIR Commissioning focuses on providing a practical organizational framework and coordinating all commissioning activities comprising hardware and beam commissioning. The integrated commissioning planning interfaces to the installation activities and takes into account the operation of the facility. The commissioning of the cryogenic plant began in August 2025. Hardware commissioning of the transport line is scheduled to start Q2/2026 followed by the First Beam Event at the end of 2026. This marks the begin of beam commissioning. The presentation outlines the commissioning strategy, timeline, and current status of the project.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Authors: REIMANN, Stephan (GSI Helmholtz Centre for Heavy Ion Research); KAMERDZHIEV, Vsevolod (GSI Helmholtz Centre for Heavy Ion Research)

Co-authors: HESSLER, Christoph (GSI Helmholtz Centre for Heavy Ion Research); SCHROEDER, Claus (GSI Helmholtz Centre for Heavy Ion Research); Dr HAGENBUCK, Frank (GSI Helmholtz Centre for Heavy Ion Research); Dr KOLLMUS, Holger (GSI Helmholtz Centre for Heavy Ion Research); Dr VOGT, Karsten (GSI Helmholtz Centre for Heavy Ion Research); SCHWARZ, Simone (GSI Helmholtz Centre for Heavy Ion Research); PIETRI, Stephane (GSI Helmholtz Centre for Heavy Ion Research); Dr RADON, Torsten (GSI Helmholtz Centre for Heavy Ion Research); VALDAU, Yury (GSI Helmholtz Centre for Heavy Ion Research)

Presenter: KAMERDZHIEV, Vsevolod (GSI Helmholtz Centre for Heavy Ion Research)

Session Classification: WEIAB WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **199** Contribution code: **TUIDC02**   Type: **Invited Oral Presentation**

Intense Heavy Ion Beam Acceleration and Operation with LEAF

Tuesday, October 21, 2025 4:30 PM (30 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: YANG, Yao (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: YANG, Yao (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: TUIDC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **200** Contribution code: **TUICC03**　　　　Type: **Invited Oral Presentation**

High Intensity Beam Commissioning and Operations of J-PARC Linac

Tuesday, October 21, 2025 2:30 PM (30 minutes)

The Japan Proton Accelerator Research Complex (J-PARC) linac has been operated with a design peak current of 50 mA since 2018, and several test operations have been performed at a higher peak current of 60 mA. Furthermore, an even higher beam current is being investigated for future projects at J-PARC. To achieve such high beam currents, it is essential to understand beam dynamics and minimize beam loss: minimizing beam extinction when generating intermediate beam pulses for injection into the downstream ring accelerator, and optimizing the lattice to control intra-beam stripping. In this talk, we present recent results from the beam commissioning in the J-PARC linac.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: OTANI, Masashi (High Energy Accelerator Research Organization)

Presenter: OTANI, Masashi (High Energy Accelerator Research Organization)

Session Classification: TUICC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **201** Contribution code: **TUIDC04**   Type: **Invited Oral Presentation**

Recent progress on FFAG beam commissioning and operational aspects

Tuesday, October 21, 2025 5:30 PM (30 minutes)

updating

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Footnotes

Author: UESUGI, Tomonori (Kyoto University)

Presenter: UESUGI, Tomonori (Kyoto University)

Session Classification: TUIDC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: **202** Contribution code: **TUIDC03**   Type: **Invited Oral Presentation**

Commissoning of the new high intensity 300keV H-injection line at TRIUMF

Tuesday, October 21, 2025 5:00 PM (30 minutes)

A new electrostatic injection for the 500 MeV cyclotron has been designed, constructed, and commissioned. Approximately 40 meters of electrostatic transport now replace the previous injection system, extending from the H⁻ ion source to the vertical injection section. The upgrade includes the integration of a second H⁻ ion source, connected through additional electrostatic beam transport, providing operational flexibility and redundancy.

A novel suppression scheme for stray magnetic fields from the cyclotron has been implemented using a continuous, in-vacuum passive mu-metal shield along the full beam transport. Beam bunching is performed with a new three-harmonic buncher, whose amplitude has been calibrated through beam-based techniques. Additional diagnostics were introduced to enable non-interceptive monitoring of beam position.

The injection system operates under ultra-high vacuum (low 10^{-8} Torr), achieved through the use of stainless steel and ceramics materials and all-metal seals. The upgrade also incorporates a next-generation multi-cusp H⁻ ion source, developed at TRIUMF, which delivers higher brightness and improved stability.

During commissioning, new high-level software applications for online tuning were deployed. These tools are now integrated into routine operation, providing enhanced automation and reproducibility of tuning procedures. Overall, the new injection system significantly improves the robustness, flexibility, and performance of cyclotron operations.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Dr BYLINSKII, Yu. (TRIUMF)

Co-authors: MARCHETTO, Marco (TRIUMF); SHELBAYA, Olivier (TRIUMF); BAARTMAN, Rick (TRIUMF); SURESH, Samarth (TRIUMF); PLANCHE, Thomas (TRIUMF); ZHANG, lige (TRIUMF)

Presenter: ZHANG, lige (TRIUMF)

Session Classification: TUIDC WGD invited oral

Track Classification: WGD:Operations and Commissioning

Contribution ID: 203 Contribution code: **WEIAC02**   Type: **Invited Oral Presentation**

The Beam Instrumentation development at IMP

Wednesday, October 22, 2025 9:00 AM (30 minutes)

updating

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Mr XIE, Hong Ming (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: Mr XIE, Hong Ming (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: WEIAC WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology

Contribution ID: **204** Contribution code: **THPT04**   Type: **Poster Presentation**

Beam Bunch Spacing Extension for Neutron Time-of-Flight Measurements at the LEAF

Thursday, October 23, 2025 5:10 PM (20 minutes)

Longer bunch spacing is essential for precise product detection in certain nuclear physics experiments. At LEAF, a 10.156 MHz pre-buncher has been successfully commissioned, producing a 98.4 ns main-bunch spacing with a measured FWHM of 1.7 ns using a fast Faraday cup. Residual satellite bunches at the 12.3 ns linac micro-pulse period necessitate a dedicated RF deflector to remove unwanted time components. Simulation results demonstrate that the designed RF deflector achieves nearly 100 % chopping efficiency while maintaining a 1.91 ns FWHM and 0.57 % energy spread, delivering a clean 100 ns beam structure. This enables suppression of pile-up and spectral overlap, thereby improving the time-of-flight resolution at LEAF.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: TANG, Yu (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: TANG, Yu (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **205** Contribution code: **THPT43**   Type: **Poster Presentation**

Modeling the dynamics of third-generation electron cyclotron resonance ion sources

Thursday, October 23, 2025 4:30 PM (20 minutes)

In the study of plasma properties of an Electron Cyclotron Resonance Ion Source (ECRIS), it is essential to accurately model the critical features of ECRIS within a numerical framework, particularly for third-generation ECRIS systems that operate at microwave frequencies exceeding 20 GHz. The three-dimensional particle-in-cell model, NAM-ECRIS, has been updated to investigate the response of the 3rd ECRIS, such as SECRAL-II, to variations in source parameters. The key process of secondary electron emission has been incorporated into the model. Additionally, the selection of appropriate secondary electron emission yields for third-generation ECRIS systems was studied.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: XINYU, Wang (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: XINYU, Wang (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: THPT poster session

Track Classification: WGB:Beam Dynamics in Linacs

Contribution ID: **207** Contribution code: **MOLBA01**   Type: **Plenary Presentation**

Heavy Ion Beam Loss Control at the Facility for Rare Isotope Beams

Monday, October 20, 2025 11:00 AM (30 minutes)

Since starting scientific user operation in May 2022, the driver linac in The Facility for Rare Isotope Beams (FRIB) at Michigan State University has provided more than a dozen ion beam species from Oxygen to Uranium to the production target. FRIB has routinely provided 20 kW primary beams on target since March 2025, which is a factor of 20 higher than at the beginning of scientific user operation. This presentation reports on the beam loss observed in the recent operations, and also discuss the approaches for their mitigation.

Footnotes

I have read and accept the Privacy Policy Statement

Yes

Funding Agency

Author: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

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Presenter: MARUTA, Tomofumi (Facility for Rare Isotope Beams)

Session Classification: MOLBA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **208** Contribution code: **MOLCA01**   Type: **Plenary Presentation**

High intensity operations of J-PARC accelerators and progress to beyond 1 MW

Monday, October 20, 2025 2:00 PM (30 minutes)

In the J-PARC accelerators (400-MeV H- linac, 3-GeV RCS and 30-GeV MR), two projects to increase beam power to more than 1 MW are now in progress. Linac and RCS achieved a 1-MW design beam power for MLF in 2024 with extremely low beam loss. This successful achievement opened a door to further beam power ramp-up beyond 1 MW. The next beam power target for MLF is now set at 1.5 MW, and both beam studies and hardware improvements are being advanced towards the new goal. MR is also in the middle of beam power upgrade to the neutrino experimental facility; we are now increasing beam power while reducing the operation cycle and increasing the beam intensity step by step in line with hardware upgrades, finally aiming to achieve 1.3 MW. The MR beam power ramp-up has been proceeding generally as planned and the routine beam power has now reached 830 kW, exceeding the original design performance of 750 kW. In addition, a 950-kW beam acceleration has also successfully been demonstrated albeit with a single shot. This talk reports on recent efforts and future prospects for increasing beam power beyond 1 MW.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: HOTCHI, Hideaki (High Energy Accelerator Research Organization)

Presenter: HOTCHI, Hideaki (High Energy Accelerator Research Organization)

Session Classification: MOLCA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **209** Contribution code: **MOLCA02**   Type: **Plenary Presentation**

Overview and Latest status of the CSNS-II project.

Monday, October 20, 2025 2:30 PM (30 minutes)

CSNS (China Spallation Neutron Source) is an accelerator-based facility that generates high-intensity short-pulse neutrons for multidisciplinary research platforms. Its accelerator system includes an 80 MeV H⁻ linac and a 1.6 GeV rapid-cycling synchrotron, with a designed target power of 100 kW. The facility has operated stably for 7 years and yielded a number of research achievements. CSNS Phase II aims to boost beam power to 500 kW and add 11 new spectrometers and experimental stations. Pre-research on key accelerator components—including H⁻ ion sources, magnetic alloy-loaded cavities, and superconducting cavities—has either progressed to mass production or been put into online commissioning. This report presents the relevant research progress.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: LIU, Huachang (Dongguan Neutron Science Center)

Presenter: LIU, Huachang (Dongguan Neutron Science Center)

Session Classification: MOLCA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **210** Contribution code: **MOLBA02**   Type: **Plenary Presentation**

Beam trip compensation for high power superconducting RF linacand progress of CiADS

Monday, October 20, 2025 11:30 AM (30 minutes)

To ensure the reliable operation of The China Initiative Accelerator Driven System (CiADS), the stringent real-time failure compensation of superconducting cavities in linac is crucial. We have developed a reinforcement learning algorithm based on segmented compensation strategy, which can achieve fast, adaptive optimization and almost instantaneous compensation scheme acquisition across diverse failure scenarios. A key-component rapid loading system was developed. Experiment results shows that the platform can restore beam energy within 20ms with an energy deviation of less than 0.5%. The above improvements will provide essential technical support for the second level failure compensation of the CiADS linac. We experimentally validated the feasibility of compensation strategy on CAFe (Verification device for CiADS linac). The online compensation experiment was carried out for the failure of cavity CM3-1 in the superconducting section. The proposed scheme successfully restored the terminal beam energy while maintaining a transmission efficiency above 99.9%, with the entire compensation process completed within 36 seconds. So far, the CiADS superconducting linac has entered the phase of mass production of equipment as well as system integration and assembly. The overall integration will be completed and the subsequent beam commissioning will be launched in September 2026.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: HE, Yuan (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: HE, Yuan (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: MOLBA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **211** Contribution code: **MOLDA01**   Type: **Plenary Presentation**

High-intensity and high-brightness effects at CERN: challenges, results and plans

Monday, October 20, 2025 4:40 PM (30 minutes)

This contribution reviews high-intensity and high-brightness effects through the CERN accelerator complex, from the H- and heavier ions' sources/linacs to the injector synchrotrons and the Large Hadron Collider (LHC), for several beam flavours and physics users. It covers various beam dynamics limitations and mitigations applied in order to reach high beam performance while maintaining low losses, for the lowest emittances, as foreseen by the LHC injector upgrade but also for Physics Beyond Collider project and towards High-Luminosity LHC. These simulations and experimental efforts for beam optimisation include optics and single particle effects coupled with incoherent collective effects such as Intrabeam-Scaterring and space-charge, coherent collective effects (instabilities, beam induced heating, e-cloud) but also beam loss handling and collimation. Prospects for the final Run 3 year (2026) but also Run 4, after the Long Shutdown 3 (LS3) are finally summarised.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Prof. PAPAPHILIPPOU, Yannis (European Organization for Nuclear Research)

Co-author: REDAELLI, Stefano (European Organization for Nuclear Research)

Presenter: Prof. PAPAPHILIPPOU, Yannis (European Organization for Nuclear Research)

Session Classification: MOLDA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E

Contribution ID: **212** Contribution code: **THIBB01**   Type: **Invited Oral Presentation**

Progress of the Beam Instrumentation development for the CSNS Upgrade

Thursday, October 23, 2025 11:00 AM (30 minutes)

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. We will also report the recent progresses on the RCS beam position monitors, the non-invasive profile monitors, e.g., the ionization profile monitor and laser-wire profile monitor, and the implementation of the novel large-diameter CNT-wire material.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Presenter: YANG, Renjun (Institute of High Energy Physics)

Session Classification: THIBB WGE invited oral

Track Classification: WGE: Beam Instrumentation, beam Interaction and AI technology