

EIC Accelerator Collaboration

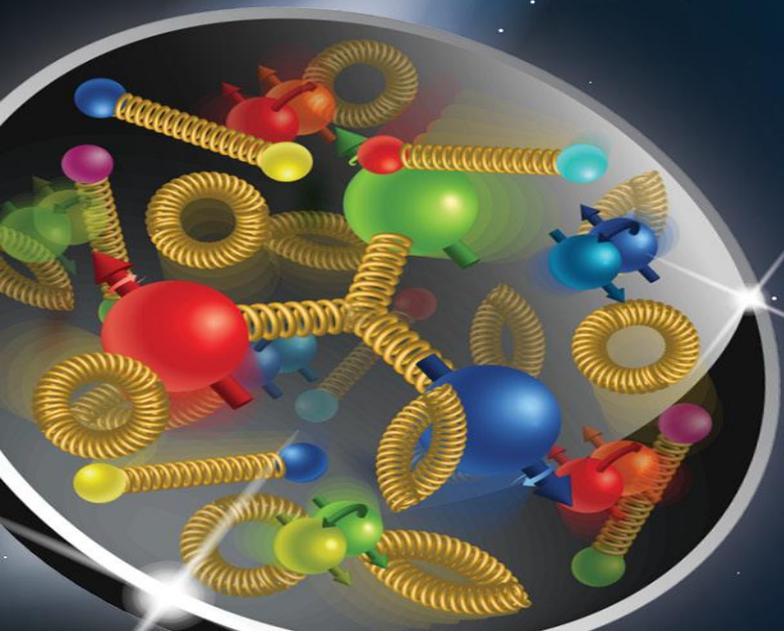
Tatiana Pieloni, École Polytechnique Fédérale de Lausanne,
Switzerland

Andrei Seryi, Jefferson Lab, USA

co-chairs of
EIC Accelerator Collaboration

IPAC 2025 Taiwan

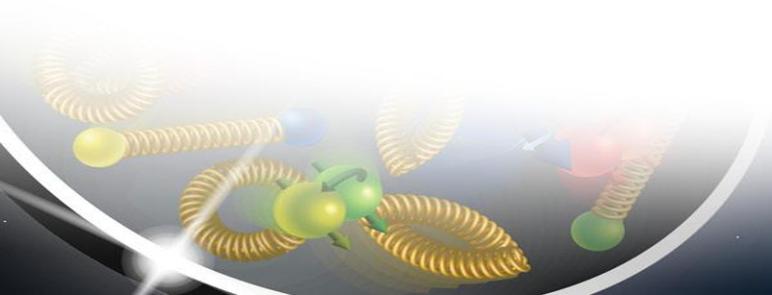
4th June 2025



Electron-Ion Collider

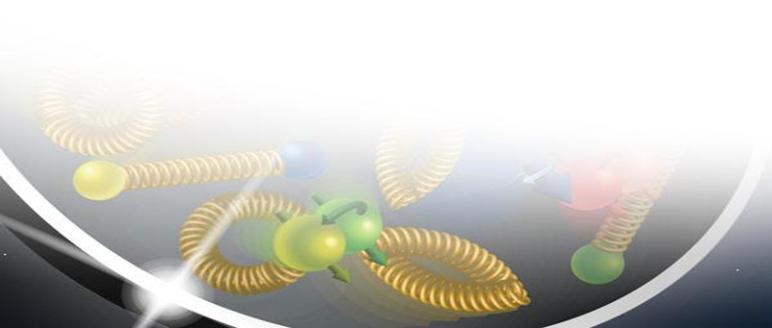
EIC Accelerator Collaboration

- The EIC design, construction, and future upgrades offer exciting scientific and technical challenges, creating **opportunities** for closely connected **worldwide accelerator R&D**
- The **EIC Accelerator Collaboration** will help realize the full potential of these opportunities
- This will benefit the EIC project, collaboration partners, and the wider accelerator community. It will also help **maximize the ultimate performance of the EIC** facility on the long-term and serve as a **bridge toward next-generation accelerators.**



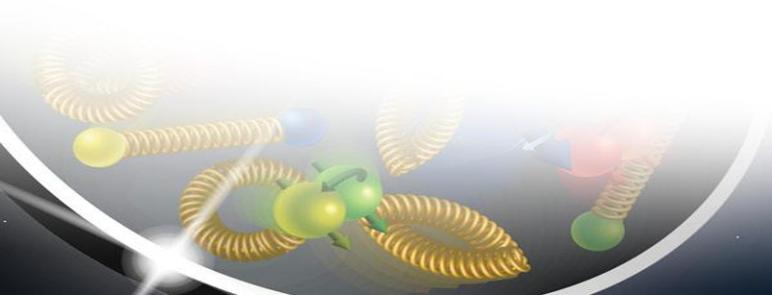
Outlook

- Structure, Official documentation, Webpage EICAC.org and [CERN Global Indico](#) page for Collaboration and WGs materials
- Details of Working groups and activities
- Input to the European Strategy for HEP
- Conclusions and Future plans



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Institutional Collaboration Board

- Established the Institutional Collaboration Board: 24 members, 24 Institutes, 9 countries.
- EIC input to the European Strategy document
- Planning to:
 - Continue expanding the ICB
 - Organizing the first meeting

Lin Liu	LNLS	Brazil
Oliver Kester	TRIUMF	Canada
Guillaume Olry	IJCLab	France
Pierre Vedrine	CEA Saclay	France
Qing Qin	ESRF	France
Ralph Assmann	GSI/FAIR	Germany
Lucio Rossi	INFN Milano	Italy
Roberto Cimino	INFN-LNF	Italy
Tae Kyun Ha	Pohang Accelerator Lab	South Korea
Jose Miguel Jimenez	CERN	Switzerland
Graeme Burt	Lancaster University	UK
Carsten Welsch	University of Liverpool	UK
Nik Templeton	STFC	UK
Phil Burrows	John Adams Institute	UK
Stewart Boogert	Cockcroft Institute	UK
Georg Hoffstaetter	Cornell University	United States
Jean Delaysen	Old Dominion University	United States
John Power	ANL	United States
Mei Bai	SLAC	United States
Sam Posen	Fermilab	United States
Sarah Cousineau	ORNL	United States
Soren Prestemon	LBNL	United States
Young-Kee Kim	University of Chicago	United States
Yue Hao	FRIB	United States

Collaboration Charter and EIC/MOU

EIC Accelerator Collaboration Charter

DRAFT Version 01, Last updated on April 16, 2024

This document represents a draft Charter for the EIC Accelerator Collaboration. The document will be reviewed by the EIC partner labs and EIC project, and will be presented at the Kick-off meeting of the EIC Accelerator Collaboration in May of 2024.

I. Background

The Electron-Ion Collider (EIC) will be a discovery machine for unlocking the secrets of the "glue" that binds the building blocks of visible matter in the universe. It will be constructed at Brookhaven National Lab on the basis of the Relativistic Heavy Ion Collider (RHIC) and consist of two intersecting accelerators: one producing an intense beam of electrons, the other one a high-energy beam of protons or heavier atomic nuclei, which are steered into collisions.

The EIC was conceived as an international project from the very beginning, and attracted larger number of collaborators from all around the world, both for experimental detector and accelerator facility. The 2020 and 2021 EIC accelerator workshops, which attracted hundreds of participants from more than 20 countries, as well as numerous technical meetings with representatives from national and international institutions, are examples of such collaboration.

The Electron-Ion Collider (EIC) partner host labs, Brookhaven National Laboratory and Jefferson Lab, are now establishing a formal international collaboration, with the purpose, structure, and operating principles as defined below.

The EIC Accelerator Collaboration functions will be largely defined and conducted through the activities of its Institutional Collaboration Board and Collaborating Working Groups. This Charter describes the purpose, structure, principles, operations, and outputs of the EIC Accelerator Collaboration.

The EIC Accelerator Collaboration Charter is:

- A living document to be maintained and modified by the Institutional Collaboration Board and its Co-Chairs.
- A procedural guide, describing the operation of the EIC accelerator collaborative work and how EIC accelerator collaboration members commit to interact constructively in good faith, and which is accompanying the EIC Accelerator Collaboration MOU, that can optionally be signed by the partner institutes who reached the stage of design and hardware contribution to the EIC.
- An informal agreement among EIC Accelerator Collaboration members that does not have any legal standing.

Coll Charter

EXPRESSION OF MUTUAL INTEREST

between

XXXX

and

YYYY

concerning

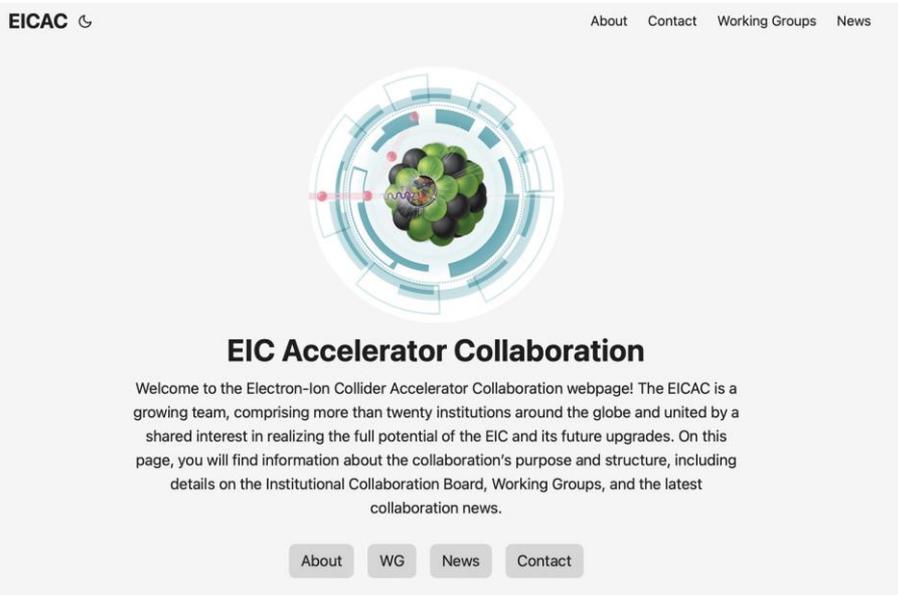
COLLABORATION ON ELECTRON ION COLLIDER ACCELERATOR SCIENCE AND TECHNOLOGIES

2024

MoU/EoI doc

Information flow and Material Sharing

Official Webpage [EICAC.org](https://eicac.org)

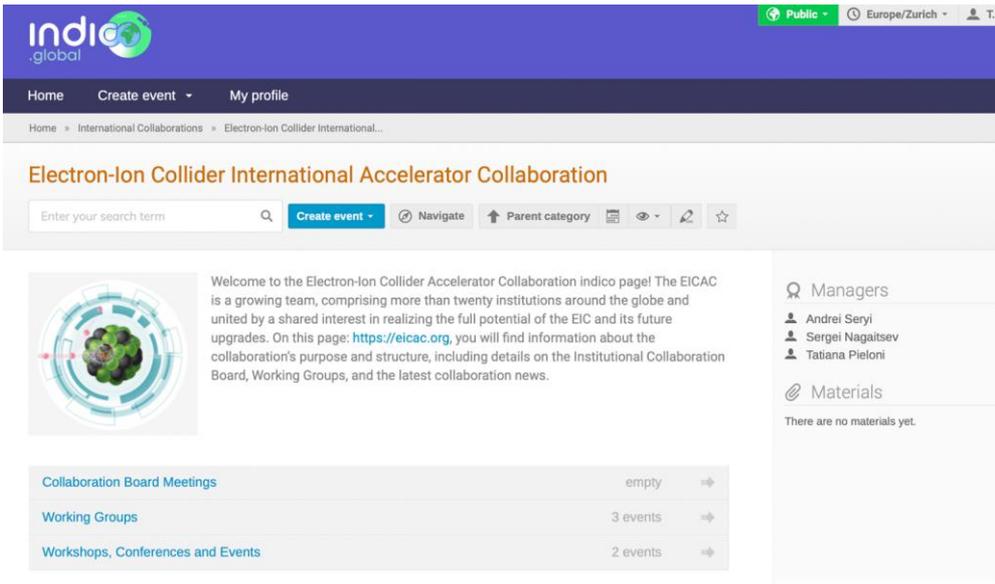


EICAC About Contact Working Groups News

EIC Accelerator Collaboration

Welcome to the Electron-Ion Collider Accelerator Collaboration webpage! The EICAC is a growing team, comprising more than twenty institutions around the globe and united by a shared interest in realizing the full potential of the EIC and its future upgrades. On this page, you will find information about the collaboration's purpose and structure, including details on the Institutional Collaboration Board, Working Groups, and the latest collaboration news.

About WG News Contact



Public Europe/Zurich

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Home International Collaborations Electron-Ion Collider International...

Electron-Ion Collider International Accelerator Collaboration

Enter your search term Create event Navigate Parent category

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Collaboration Board Meetings	empty
Working Groups	3 events
Workshops, Conferences and Events	2 events

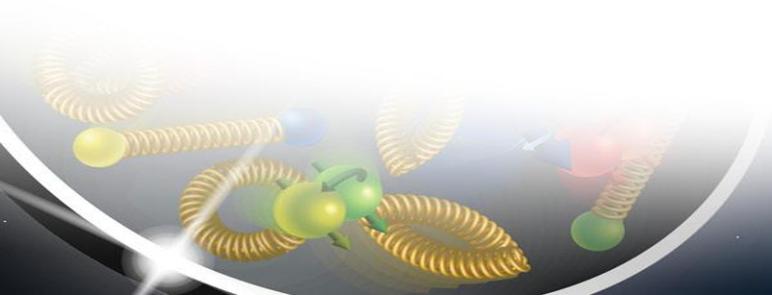
Managers
Andrei Seryi
Sergei Nagaitsev
Tatiana Pieloni

Materials
There are no materials yet.

All WG meetings and material will be migrated soon to: [CERN Global Indico](https://cern-global-indico.org)

Outlook

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- **Details of Working groups and activities**
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Working Groups on key challenges

1. **Beam-beam effects** C. Montag (BNL), X. Buffat (CERN)
2. **Polarized Beams and Polarimetry** F. Rathmann (BNL), G. Hoffstaetter(Cornell)
3. **EIC commissioning Tools** Y. Hao (MSU/BNL), J.L. Vay (LBNL)
4. Second Interaction Region – recruiting group leaders and co-chair
5. High Energy Beam Cooling - recruiting group leaders and co-chair
6. Collimation and machine protection – group leaders identified
7. Injection and sources R&D – group leaders identified
8. Forum on EIC Synergies with Current and Future Projects - recruiting group leaders and co-chair

More WGs to come → Feel free to propose topics and technologies of interest

Polarized Beam and Polarimetry WG

Coordinators: Georg Hoffstaetter de Torqua and Frank Rathmann

Focus on important EIC-specific and general topics of polarized beams such as:

- **Theory** of spin dynamics in storage rings, including radiative depolarization, spin diffusion, and beam-beam forces.
- Spin **simulation** tools for polarized beams.
- Polarized beam **manipulation and optimization** techniques.
- Polarized **hadron** and atomic beam **sources** for protons, deuterons and Helios.
- Theory and technology of **polarimetry**, based on pp, dd and ^3He - ^3He scattering.
- Polarized **electron sources**.
- **Electron polarimetry** based on Compton scattering.

Registered group members: 24 members from 8 institutions

Purpose:

Identify topics for polarized EIC beams that can receive significant attention from outside BNL.

Identify and form groups that attend to pertinent topics.

Identify funding sources (especially outside BNL).

Identify potential and help in manpower development.

Maintain contact to respective BNL groups and experts for polarized beams.

Recent contributions to polarized EIC beams

- [1] [BAGELS for simultaneous polarization, orbit, and optics control in electron storage rings](#) M. G. Signorelli, G. H. Hoffstaetter (CLASSE), PRAB 28, 031002, Mar 2025
- [2] [Polarization transmission to high energy at the EIC's HSR](#) E. Hamwi, G. H. Hoffstaetter (CLASSE), K. Hock, H. Huang (BNL), PSTP 2024
- [3] [Polarization preservation methods for the Electron Storage Ring of the EIC](#) M. Signorelli, G. Hoffstaetter (CLASSE), Y. Cai (SLAC), A. Connelly (Bard College), J. Kewisch, D. Marx, C. Montag, S. Tepikian, V. Ptitsyn (BNL), IPAC 2024
- [4] [BAGELS: A general method for minimizing the rate of radiative depolarization in electron storage rings](#) M. Signorelli, G. Hoffstaetter (CLASSE), Y. Cai (SLAC), IPAC 2024
- [5] [Snake matching the EIC's hadron storage ring](#) E. Hamwi, G. Hoffstaetter (CLASSE), H. Huang, K. Hock, V. Ptitsyn (BNL), IPAC 2024
- [6] [Simulations of polarized helions in the HSR](#) K. Hock, F. Meot, H. Huang, V. Ptitsyn (BNL), E. Hamwi (CLASSE), IPAC 2024
- [7] [Proton polarization in RHIC with partial Siberian snakes](#) E. Hamwi, G. Hoffstaetter (CLASSE), IPAC 2024
- [8] [Various methods for computing dominant spin-orbit resonance strengths in storage rings](#) J. Devlin, G. Hoffstaetter (CLASSE), IPAC 2024
- [9] [Modeling interference of two first-order resonances with two Siberian snakes using machine learning](#) E. Hamwi, G. Hoffstaetter, J. Devlin (CLASSE), D. Barber (DESY), IPAC 2024
- [10] [AGS Booster model calibration and digital-twin development](#) W. Lin, D. Sagan, G. Hoffstaetter (CLASSE), B. Huang (Stony Brook), K. Brown, K. Hock, N. Isenberg, N. Urban, V. Schoefer (BNL), Y. Wang (RPI), IPAC 2024
- [11] [Optimization of AGS bunch merging with reinforcement learning](#) Y. Gao, K. Zeno, K. Brown, L. Nguyen, V. Schoefer (BNL), D. Sagan, E. Hamwi, G. Hoffstaetter, J. Unger, W. Lin (CLASSE), A. Kasparian, M. Schram (TJNAF), A. Edelen (SLAC), Y. Wang (RPI), IPAC 2024
- [12] [Comprehensive modeling of Siberian Snakes in BNL's AGS: symplectic tracking and optical compensation](#) E. Hamwi, G. Hoffstaetter, W. Lin (CLASSE), V. Schoefer (BNL), IPAC 2024
- [13] [Higher-order spin depolarization analysis](#) E. Hamwi, G.H. Hoffstaetter (CLASSE), IPAC 2023
- [14] [Electron polarization preservation in the EIC](#) M.G. Signorelli, G.H. Hoffstaetter (CLASSE), V. Ptitsyn (BNL), IPAC 2023
- [15] [Machine Learning Applications for Orbit and Optics Correction at the Alternating Gradient Synchrotron](#) W. Lin, G.H. Hoffstaetter, D. Sagan (CLASSE), K.A. Brown, V. Schoefer (BNL), B. Huang, W. Dai, T. Robertazzi (Stony Brook), IPAC 2023
- [16] [AGS Booster Beam-based Main Quadrupole Transfer Function Measurements](#) W. Lin, G.H. Hoffstaetter, D. Sagan (CLASSE), P. Adams, K.A. Brown, Y. Gao, V. Schoefer (BNL), B. Huang, W. Dai, T. Robertazzi (Stony Brook), B. Dhital (Old Dominion), IPAC 2023
- [17] [Generalized Gradient Map Tracking in the Siberian Snakes of the AGS and RHIC](#) W. Lin, E. Hamwi, G.H. Hoffstaetter, D. Sagan (CLASSE), V. Schoefer (BNL), IPAC 2023
- [18] [Spin Matching for the EIC's Electrons](#) M.G. Signorelli, J.A. Crittenden, G.H. Hoffstaetter (CLASSE), J. Kewisch (BNL), IPAC 2022
- [19] [T-BMT Spin Resonance Tracker Code for He3 With Six Snakes](#) V.H. Ranjbar, H. Huang, Y. Luo, F. Méot, V. Ptitsyn (BNL), G.H. Hoffstaetter, D. Sagan (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education), F. Lin, V.S. Morozov (JLab), IPAC 2021

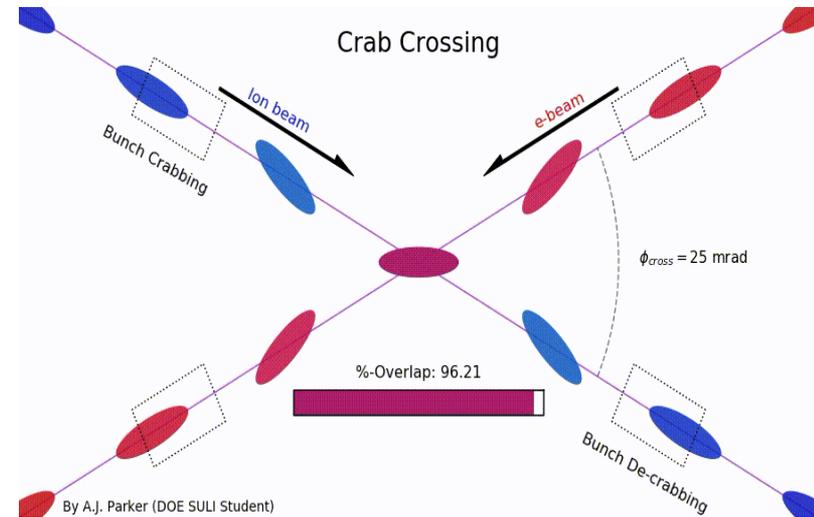
Parameters for Highest e-p Luminosity

- **Hadron beam**
parameters similar to present RHIC, but "flat" beams with an emittance ratio of $\frac{\epsilon_y}{\epsilon_x} = 0.1$ and many more bunches
- **Electron beam**
parameters resemble a (polarized) B-Factory

	proton	electron
no. of bunches		1160
energy [GeV]	275	10
bunch intensity [10^{10}]	6.9	17.2
beam current [A]	1.0	2.5
ϵ_{RMS} hor./vert. [nm]	9.6/1.5	20.0/1.2
$\beta_{x,y}^*$ [cm]	90/4	43/5
b.-b. param. hor./vert.	0.014/0.007	0.073/0.100
σ_s [cm]	6	2
$\sigma_{dp/p}$ [10^{-4}]	6.8	5.8
τ_{IBS} long./transv. [h]	3.4/2.0	N/A
L [$10^{33} \text{ cm}^{-2} \text{ sec}^{-1}$]		10.05

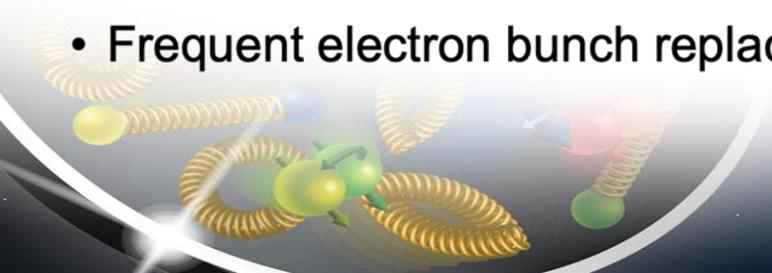
Beam-Beam Crossing

- Interaction region is based on 25 mrad crossing to minimize l^* for both beams
- Head-on collision geometry is restored by rotating the bunches before colliding (“crab crossing”)
- Bunch rotation (“crabbing”) is accomplished by transversely deflecting SRF resonators (“crab cavities”)
- Actual collision point moves laterally during bunch interaction – to be taken into account in Physics analysis



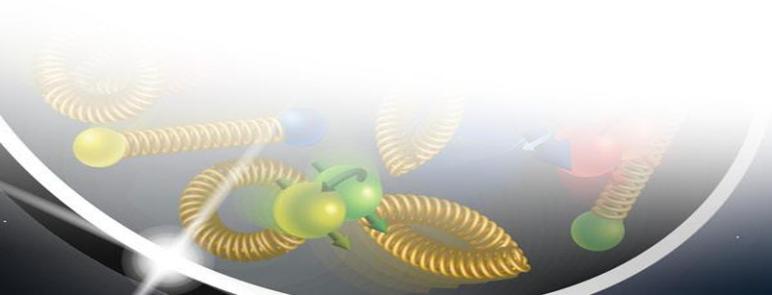
Beam-Beam Challenges in EIC

- Different species – electrons and hadrons
- Polarized electron and proton beams
- High beam-beam parameters, at the beam-beam limits established at KEKB and RHIC
- Large 25 mrad crossing angle
- Crab crossing of hadrons and electrons
- Flat hadron beam emittances - $\frac{\epsilon_y}{\epsilon_x} = 0.09$
- Not-so-flat electron beam emittances - $\frac{\epsilon_y}{\epsilon_x} = 0.1$ – challenging for polarization
- Frequent electron bunch replacement to maintain high polarization



Purpose of the WGs

- Not a review
 - Not a workshop
 - Modeled after International SuperKEKB Task Forces
 - Scrutinize EIC on different aspects: BB, polarization...
 - Provide honest feedback
 - All participants are invited to contribute with their own studies
- Knowledge transfer and maximize performances



Working Groups next steps

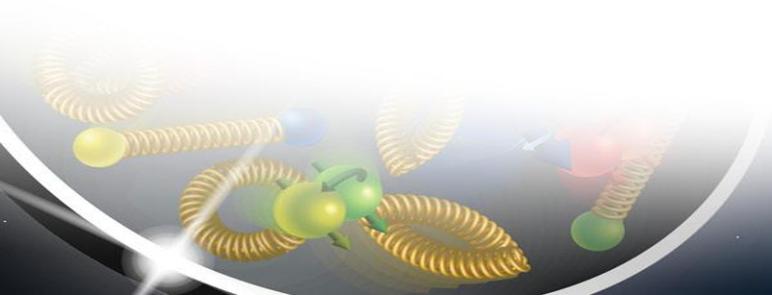
- Work on forming new WGs
- Expressions Of Interests submitted (more than 120 names) will be used as initial lists to seed WGs and look for WG leaders
- Co-chairs are also plan to be personally active in some of the WGs
- Gather feedback from the community

Follow this QR code link to register and share your interest →



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Input to European Strategy for Particle Physics

- Drafted document as EIC input to the European Strategy for Particle Physics
 - Scientific Research
 - Accelerator Technology
 - Educational Exchanges
- Presentation and discussions at the **APS Divisions of Particles and Fields (DPF) and Physics and Beams (DPB) Forum** on 27th February
- Review period among the EICAC
- Submission to ESPP

216. [Advancing Global Collaboration through the Electron-Ion Collider \(EIC\)](#)

The Electron-Ion Collider (EIC) at Brookhaven National Laboratory represents a groundbreaking opportunity to explore the fundamental structure of matter by colliding polarized electron beams with polarized hadron beams. This facility is designed to address critical questions in Quantum Chromodynamics (QCD), particularly the role of gluons in binding

Input to European Strategy for Particle Physics

Electron-Ion Collider Accelerator Collaboration input to ESPP, March 2025

Register to endorse



<https://indico.global/event/14314/>

**Endorsing can be done any time until
European Strategy conclusions converge!**

Title

Advancing Global Collaboration through the Electron-Ion Collider (EIC)

Abstract:

The Electron-Ion Collider (EIC) at Brookhaven National Laboratory represents a groundbreaking opportunity to explore the fundamental structure of matter by colliding polarized electron beams with polarized hadron beams. This facility is designed to address critical questions in Quantum Chromodynamics (QCD), particularly the role of gluons in binding quarks within nucleons and nuclei. With the potential to achieve luminosities up to $\sim 10^{34}$ cm⁻²s⁻¹, the EIC will rely on cutting-edge technologies such as hadron beam cooling, spin-transparent optics, crab cavities, and advanced superconducting magnets.

In addition to advancing scientific knowledge, the EIC project offers a unique opportunity for international collaboration, particularly for European institutions. By contributing to the EIC, European researchers will play a pivotal role in enhancing accelerator technology and advancing QCD research. Furthermore, this collaboration will foster innovation in accelerator technologies such as superconducting RF cavities and polarized beams dynamics, benefiting future accelerator projects worldwide.

The proposed EIC Accelerator initiative aims to provide a platform for collaboration and discussion, focusing on facilitating opportunities for US and European institutions to contribute to the EIC's construction and future upgrades. This initiative will also serve as a vital communication channel between the accelerator R&D community and EIC stakeholders, guiding the long-term development of the facility and exploring opportunities for future accelerator technologies. By taking a forward-thinking approach, the initiative will help ensure that the EIC remains at the forefront of accelerator innovation and contributes to the success of future particle colliders, serving as a testbed for new accelerator physics concepts and technologies.

[Full Document](#)

Electron-Ion Collider

Input to European Strategy for Particle Physics

We have a unique opportunity to actively shape a new facility by integrating concepts and technologies that align with the goals of the EIC and even extend them in a longer term.

- This facility can become a powerful **platform for advancing beam dynamics and diagnostics concepts** already at the conceptual level
- EIC could serve as a **dedicated test bench for technology development** and exploration relevant to future machines.
- Valuable environment for the **education and training** of the next generation of operators, engineers, and physicists in both hadron and lepton operations—bridging the gap to future colliders/accelerators

This facility will not only support technical innovation but also play a crucial role in **developing talent and expertise** for the future of accelerator science.

Conclusions and future plans

The EIC is more than the next great physics machine — it's a rare chance for the accelerator community to shape the future, gain hands-on experience, and invest in the technologies and talent that will carry us toward the Future.

- EIC Accelerator Collaboration has been established and ICB meetings will kickoff
- Working Groups on key technological challenges have been created and are operational
- New WGs have been identified and reach for chairs and co-chairs are on-going (i.e. Instrumentation and Diagnostics, EIC and Future Accelerators forum, Injectors R&D...)
- EIC contribution to European Strategy has been submitted
- Identify new partners scientific interests and facilitate collaboration
 - In-kind contributions: technology opportunities
 - Design and R&D studies: opportunity to bust the EIC reach and explore concepts for Future accelerators (instrumentation, collimation strategies...)

Thank you!

The Future is Now!

Follow the QR code link to
register and share your interest →

