Brookhaven National Laboratory | Jefferson Lab | U.S. DEPARTMENT of ENERGY | Office of Science

EIC Project Update

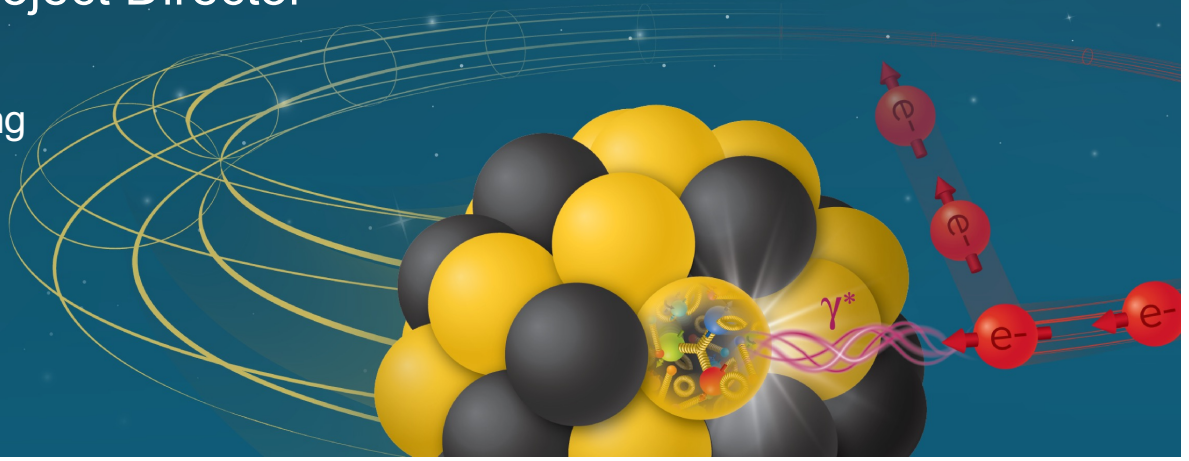
Jim Yeck

Associate Lab Director & EIC Project Director

EIC User Group/ePIC Collaboration Meeting

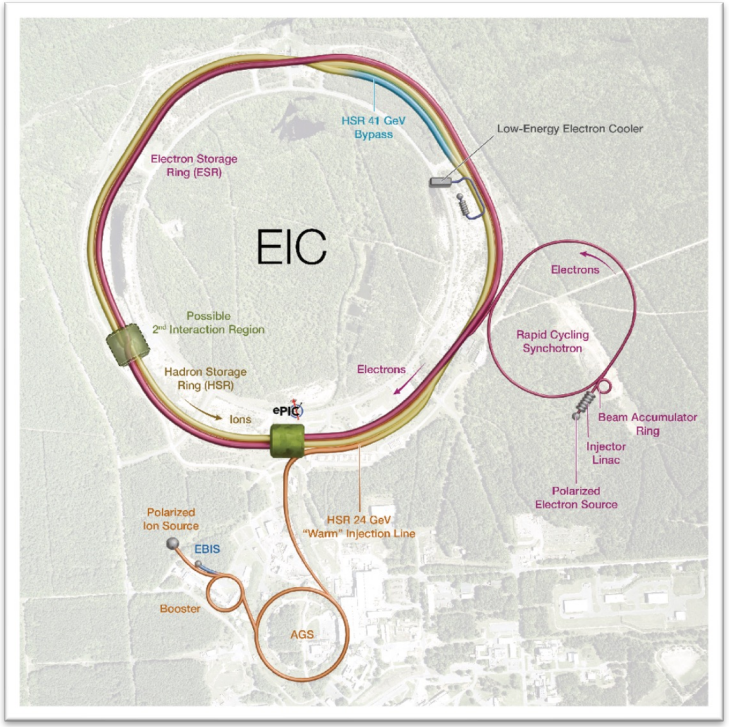
July 14, 2025

Electron-Ion Collider



Facility Performance Requirements

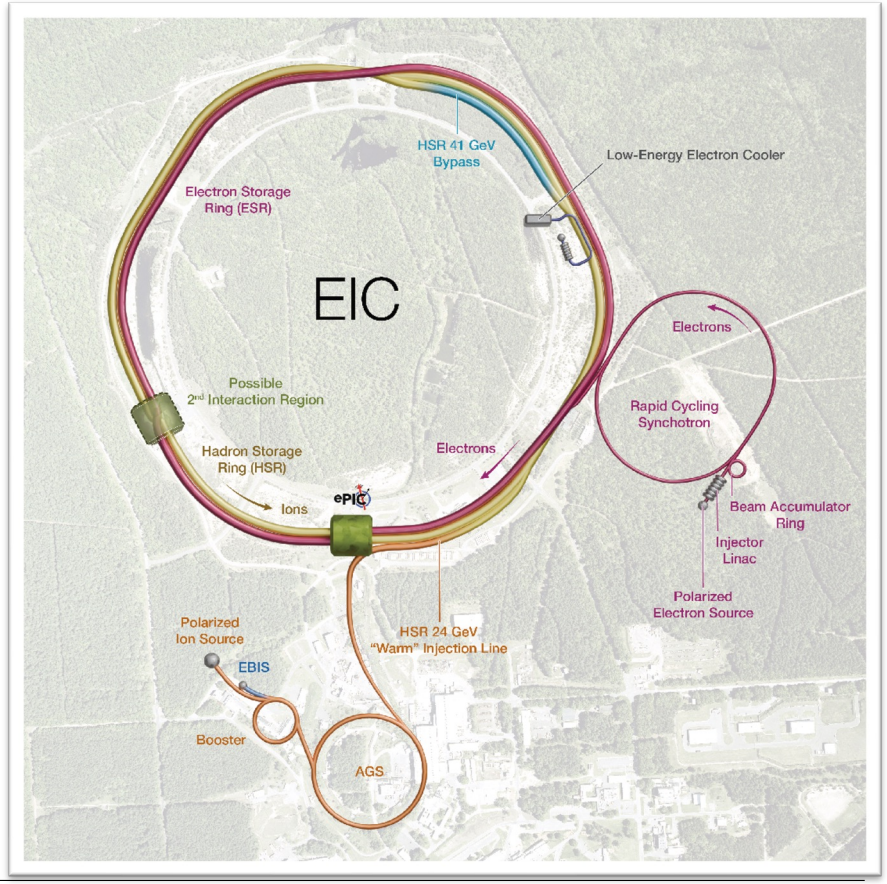
- High Luminosity: L= 10^{33} – 10^{34}cm^{-2}sec^{-1}
- Highly Polarized Beams: 70%
- Large Center of Mass Energy Range: E_{cm} = 20 – 140 GeV
- Large Ion Species Range: protons – Uranium
- Large Detector Acceptance and Good Background Conditions
- Possibility to implement a Second Interaction Region (IR)



The EIC design, project scope, and performance parameters address the requirements established by the U.S. Nuclear Science Advisory Committee (NSAC) Long Range Plans (2015 & 2023) and endorsed by the U.S. National Academy of Sciences (2018).

EIC Accelerator Concept and Parameters

- ✓ Polarized ion/proton source
- ✓ Ion injection and initial acceleration systems:
  - Linac (200 MeV)
  - Booster (1.5 GeV)
  - AGS (25 GeV)
- UPGRADE Hadron Storage Ring (40-275 GeV)
- NEW Electron Pre-Injector (750 MeV Linac)
- NEW Electron Rapid Cycling Synchrotron (0.75 GeV – Top Energy)
- NEW Electron Storage Ring (5 GeV – 18 GeV)
- NEW Interaction Region(s)
- NEW Hadron Injection Cooling System



DOE CD-3B/Status Review Summary

DOE Independent Project Review (IPR) Comments:

- The project team has made excellent progress since the last review. There is an experienced team in place. A new Technical Director was recently hired and has already made a positive impact on the project. Focused on technical and performance risks.
- The project has strong support from the BNL and JLab Directors. Communications between the labs are well established with bi-weekly meetings between the two lab Directors and Deputy Directors. This will be an excellent forum to facilitate constructive resolution of issues and risks as they arise. New JLab Director, transition into subprojects, navigating funding constraints and uncertainties, …

Recommendations for the EIC Project:

- **Proceed to CD-3B** Approval paused pending clarity on FY26 budget details and staff planning.
- Path to baseline
  - In advance of the next IPR, document the scope of the EIC project and gain alignment with the Program Office on mission need achievement. EIC "Portfolio" scope definition well advanced and led by the BNL Portfolio Coordinator, Erik Johnson. Meetings with DOE ONP to reach a common interpretation of mission need requirements.
  - Develop details for the subproject strategy and work with the Program Office and FPD to **conduct a focused IPR in 6 months.** DOE Independent Project Review scheduled for August 5-7, 2025.

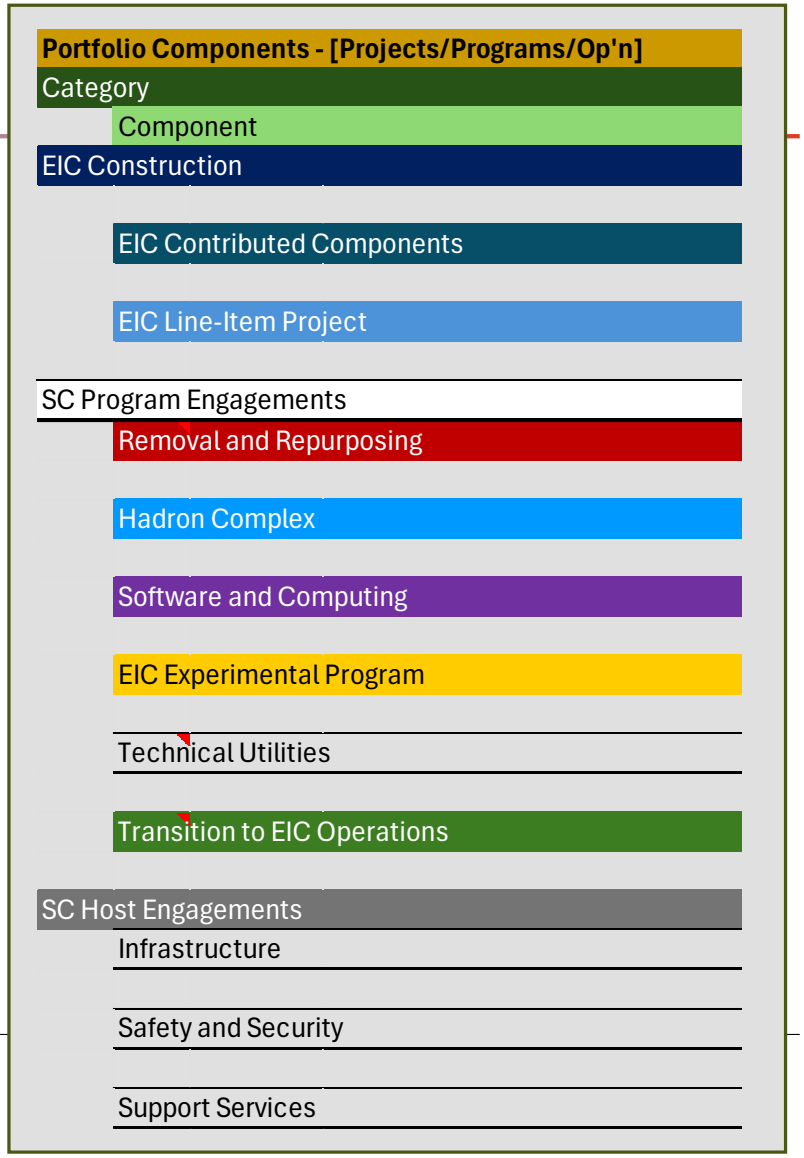
EIC Portfolio

Project Scope and Dependencies	
DOE EIC Line-Item Project (Subprojects)	DOE Order 413.3B, Resource Loaded Schedule (P6), Earned Value Management System (EVMS), Reporting, etc. Contingency included to cover the risks associated with In-Kind Contributions and the NYS ESD Grant.
In-Kind Contributions Accelerator/Detector	Deliverables/specifications agreed with Partners and Partners secure funding. Milestones in P6 with schedule tracking and technical integration.
NYS	P6, EVMS, NYS ESD Grant Compliance.
Off-Project Scope and Dependencies	
Accelerator & Infrastructure	Maintaining existing BNL accelerators, infrastructure, and lifetime extension needed for EIC. RHIC Removal and Repurposing (D&D) as needed for EIC. DOE ONP Review in September.
Detector	BNL and JLab facilities and resources required for the success of the EIC experimental program.
Host Laboratory	BNL support for the EIC project, guests, and users.

Portfolio Components

Erik Johnson, Portfolio Coordinator

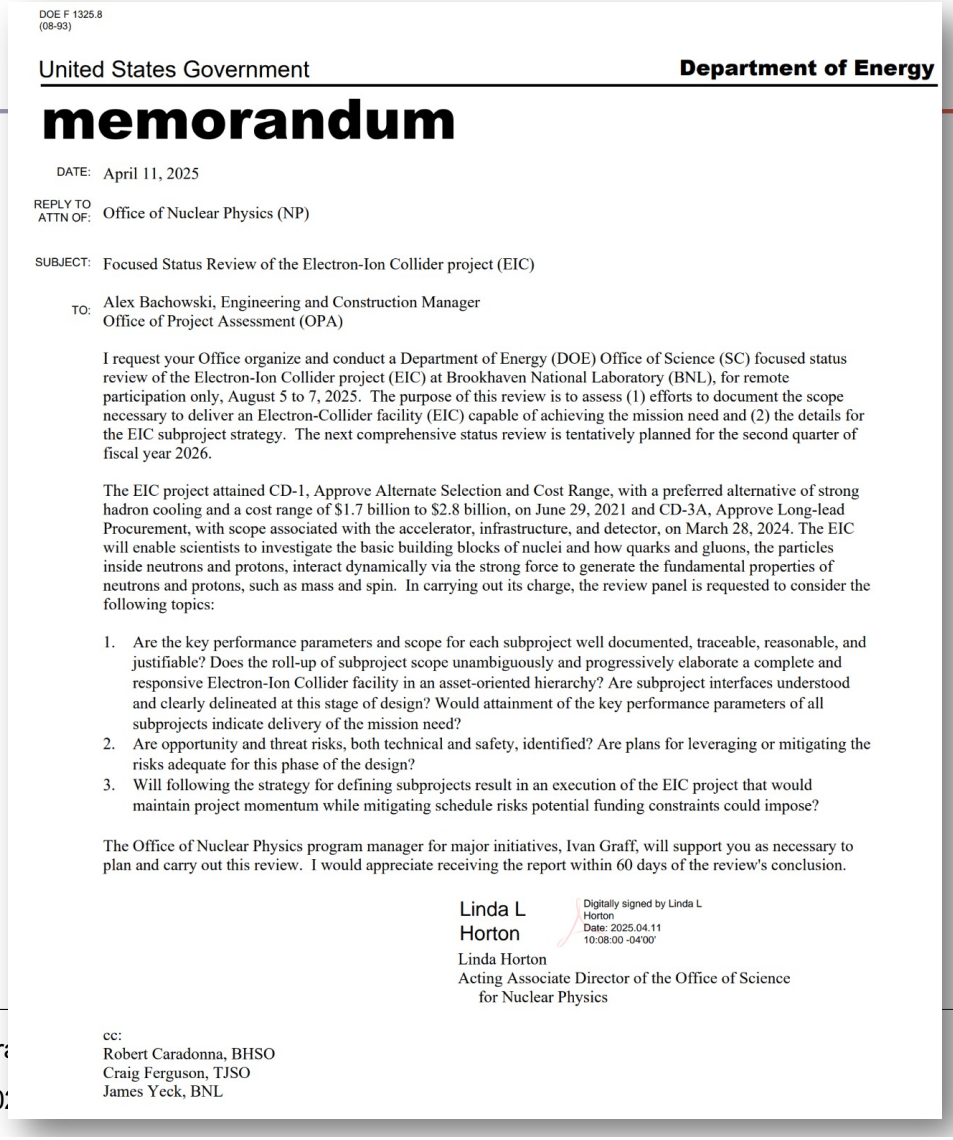
- How do you populate the portfolio **Elements**
- Need to evaluate the scope in the **Components** and translate it into the portfolio.
- Can be organized into three broad **Categories**
  - EIC Construction
  - SC Program Engagements
  - SC Host Engagements



DOE IPR August 5-7

Project Director's goals for the review:

- Confirm that the EIC facility design meets the DOE approved Mission Need.
- Gain DOE support for the EIC subproject delivery strategy and plans.
- Confirm that sufficient progress on the subprojects to provide a reasonable understanding of the scope, cost, schedule, and funding requirements for the entire EIC line-item project.
- Confirm adequate progress defining the scope of the EIC Portfolio (off-project dependencies) to move forward with EIC construction approvals.
- Support for science program during commissioning.
- Support for scheduling CD approval reviews of the Accelerator Storage Rings subproject (CD-2/3) and Detector (CD-2) in 2026.



DOE F 1325.8
(08-93)

United States Government **Department of Energy**

memorandum

DATE: April 11, 2025

REPLY TO ATTN OF: Office of Nuclear Physics (NP)

SUBJECT: Focused Status Review of the Electron-Ion Collider project (EIC)

TO: Alex Bachowski, Engineering and Construction Manager
Office of Project Assessment (OPA)

I request your Office organize and conduct a Department of Energy (DOE) Office of Science (SC) focused status review of the Electron-Ion Collider project (EIC) at Brookhaven National Laboratory (BNL), for remote participation only, August 5 to 7, 2025. The purpose of this review is to assess (1) efforts to document the scope necessary to deliver an Electron-Collider facility (EIC) capable of achieving the mission need and (2) the details for the EIC subproject strategy. The next comprehensive status review is tentatively planned for the second quarter of fiscal year 2026.

The EIC project attained CD-1, Approve Alternate Selection and Cost Range, with a preferred alternative of strong hadron cooling and a cost range of $1.7 billion to $2.8 billion, on June 29, 2021 and CD-3A, Approve Long-lead Procurement, with scope associated with the accelerator, infrastructure, and detector, on March 28, 2024. The EIC will enable scientists to investigate the basic building blocks of nuclei and how quarks and gluons, the particles inside neutrons and protons, interact dynamically via the strong force to generate the fundamental properties of neutrons and protons, such as mass and spin. In carrying out its charge, the review panel is requested to consider the following topics:

1. Are the key performance parameters and scope for each subproject well documented, traceable, reasonable, and justifiable? Does the roll-up of subproject scope unambiguously and progressively elaborate a complete and responsive Electron-Ion Collider facility in an asset-oriented hierarchy? Are subproject interfaces understood and clearly delineated at this stage of design? Would attainment of the key performance parameters of all subprojects indicate delivery of the mission need?
2. Are opportunity and threat risks, both technical and safety, identified? Are plans for leveraging or mitigating the risks adequate for this phase of the design?
3. Will following the strategy for defining subprojects result in an execution of the EIC project that would maintain project momentum while mitigating schedule risks potential funding constraints could impose?

The Office of Nuclear Physics program manager for major initiatives, Ivan Graff, will support you as necessary to plan and carry out this review. I would appreciate receiving the report within 60 days of the review's conclusion.

Linda L Horton
Digitally signed by Linda L Horton
Date: 2025.04.11 10:08:00 -04'00'

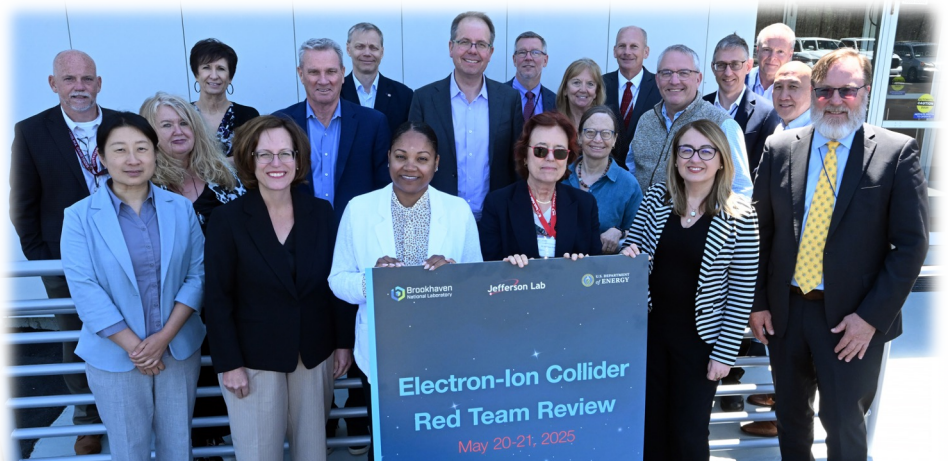
Linda Horton
Acting Associate Director of the Office of Science
for Nuclear Physics

cc:
Robert Caradonna, BHSO
Craig Ferguson, TJSO
James Yeck, BNL

Red Team Review May 20-21, 2025

Red Team Members
Thomas Glasmacher, MSU/FRIB (Chair)
Karsten Heeger, Yale University
Barbara Jacak, LBNL
Jim Kerby, FNAL
Jay Marx, LIGO-retired (Remote)
Ritchie Patterson, Cornell University
Elmie Peoples-Evans, ANL
Mark Reichanadter, SLAC-retired

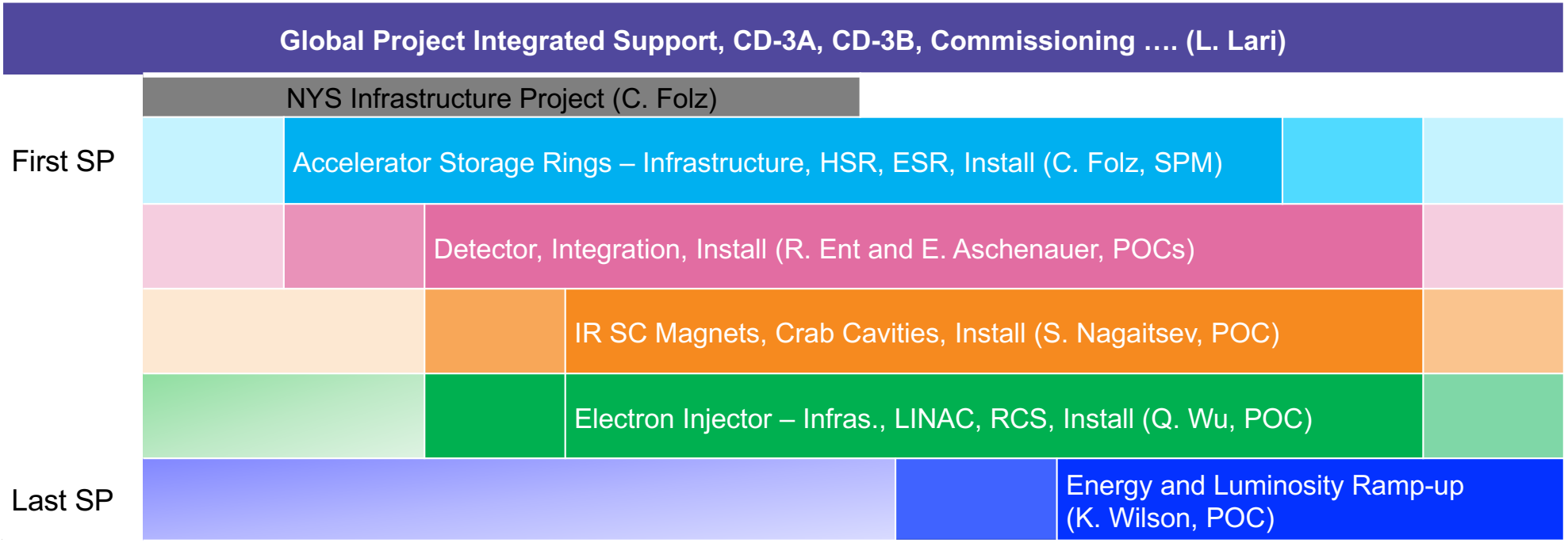
Approach
- EIC PAC plus additional experts.
- Identified strengths and weakness in the strategy for transitioning EIC into construction.
- Recognized uncertainties, particularly funding, will not be resolved as the project prepares to enter the construction phase.
- Recognize the importance of retaining and strengthening stakeholder support.



Results
- Supported project delivery strategy.
- Strong encouragement to move EIC into construction in 2026.
- Generous advice provided in the review and the written report.
- Follow-up meetings with Red Team members underway.

Project Delivery Strategy

Deliver the full EIC facility scope using subprojects and the phased implementation of the EIC project scope. The strategy enables the start of the EIC construction when the first subproject is ready and the start of the EIC science program during collider commissioning, concurrent with the final subproject equipment installation. Line-Item Construction Project includes the full scope required to meet EIC facility performance requirements.

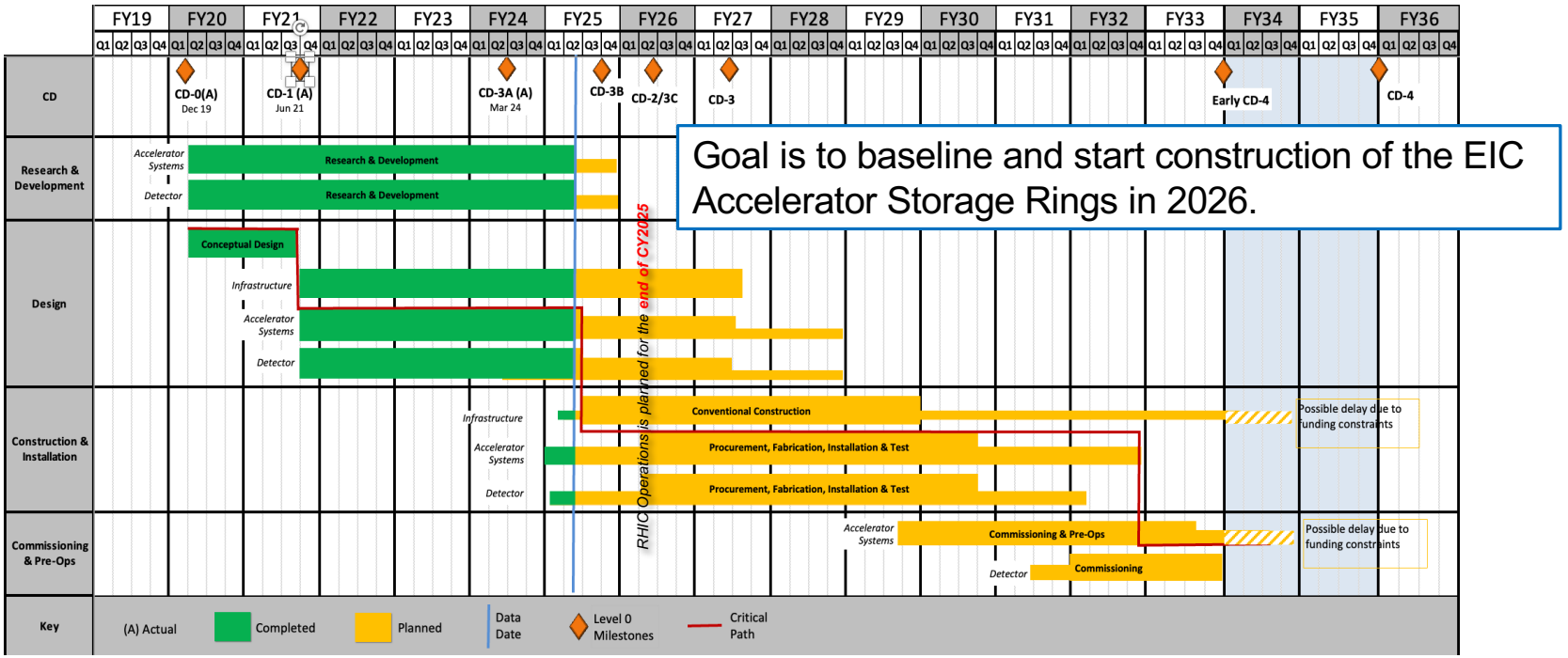


EIC Construction Project

CD-3x & NYS Scope	**CD-3A, Long Lead Procurement**	3A: ~40% scope in ASR; ~6% IR; 54% in DET
	CD-3B, Long Lead Procurement	3B: ~75% scope in ASR; 25% DET
	NYS Civil Construction Project	Site Preparation work and construction of Service Buildings and support systems related to the ASR subproject.
Initial Science Program Scope	**Accelerator Storage Rings (ASR)**	Hadron Storage Ring Modifications, Electron Storage Ring (10 GeV) and related infrastructure.
	Detector (DET)	ePIC Detector including SC magnet, detector systems, and integration and installation.
	Interaction Region (IR)	Interaction Region including the SC magnets and 197 MHz crab cavities.
	Electron Injectors (EIN)	Electron Injectors (LINAC, BAR & RCS @ 10 GeV) and related infrastructure.
Full Scope	**Energy and Luminosity Ramp-up (ELR)**	Accelerator scope required to increase Energy (18GeV e-, RCS SRF & Cryo, 394 MHz crab cavities, 41 GeV by-pass, ESR and HSR RF amplifiers, etc.)
PM & CX	**Project Management and Global Services (PMG)**	Project and Technical integration support to entire project and integration and beam commissioning.

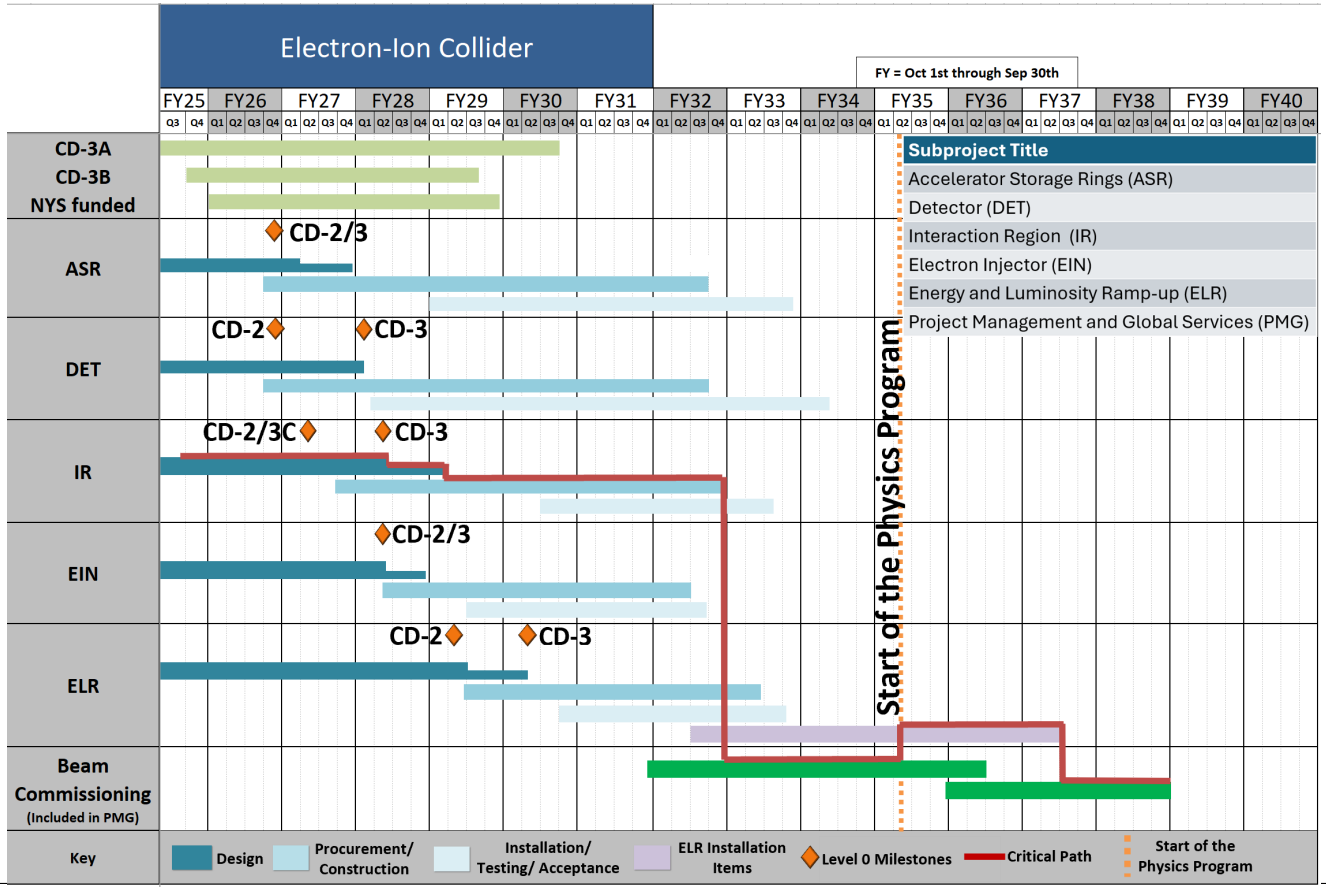
In-Kind Contribution Plan: 5% or more of the accelerator scope and 30% of the detector scope. New accelerator opportunities.

EIC Reference Schedule

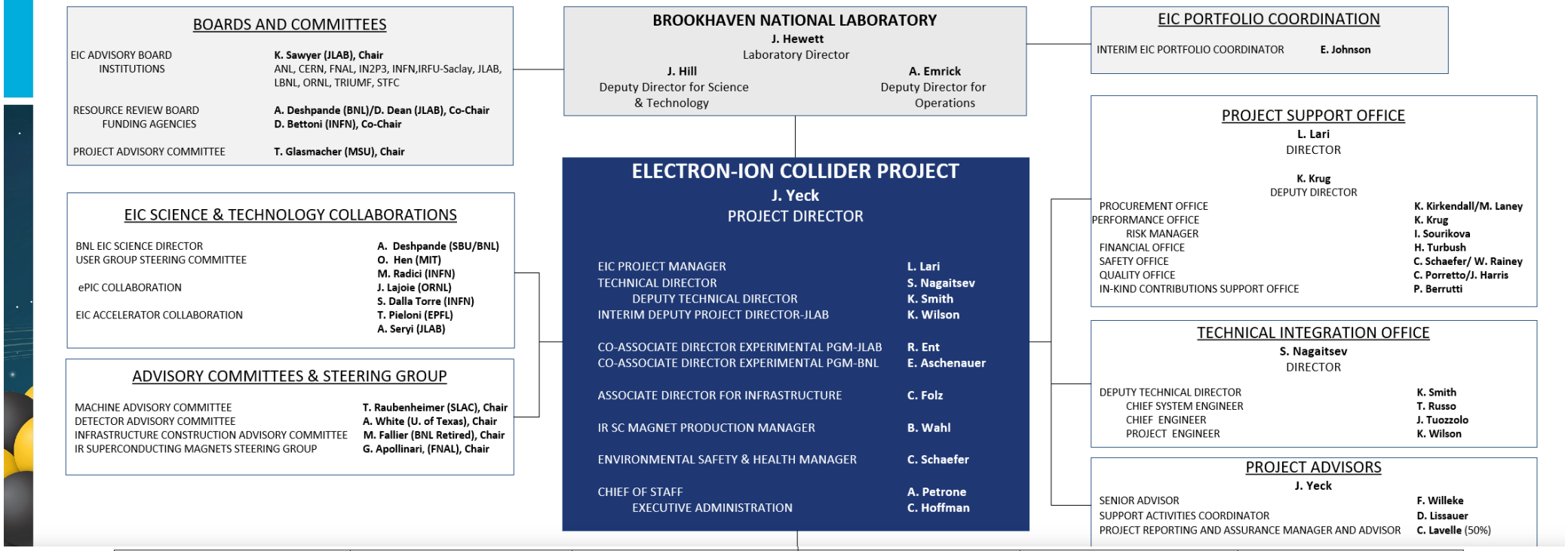


- To be revised based on subproject delivery strategy and updated annual funding assumptions.

EIC Reference Schedule - Subprojects



EIC Project Delivery Organization



- Leadership of subprojects superimposed on the existing EIC project organization
- Significant technical scope in Infrastructure, Accelerator Systems, RF, Cryogenics delivered in multiple subprojects.
- Stronger technical integration effort will be required.

DOE and EIC Planning Dates

Milestone		Milestone	
DOE Independent Project Review (IPR)	**Jan. 7-9, 2025**	**DOE RHIC R&R/Injector Operations Review**	**Sept. 8-10, 2025**
Start Developing Scope of Subprojects	January 10, 2025	Machine Advisory Committee Meeting	Sept. 16-18, 2025
IR SC Magnet Steering Group Meetings in 2025	January 17, 2025	Infrastructure Construction Advisory Committee	October 2025
Project Advisory Committee Meeting	February 11, 2025	Resource Review Board Meeting (BNL)	Nov. 4-5, 2025
EIC Advisory Board Meeting	February 25, 2025	Assessments of Baseline Readiness for SPs • Detector • Interaction Region • Accelerator Rings • Global and Energy and Luminosity Ramp-Up	End of 2025 Nov. 12-14, 2025 Nov. 18-20, 2025 Dec. 2025 Dec. 2025
Electron Injector Design and Cost Review	April 8-10, 2025		
Infrastructure Construction Advisory Committee	April 16-17, 2025		
Project Advisory Committee "Red Team" Review	May 20-21, 2025		
Resource Review Board Meeting (Prague)	June 5-6, 2025		**2026**
Detector Advisory Committee Meeting	June 11-13, 2025	RHIC Operations Conclude	~End 2025
EIC Advisory Board Meeting	June 17, 2025	RHIC Removal and Repurposing (R&R) Starts	~Early 2026
DOE CD-3B ESAAB Approval	Pending	**DOE IPR and Independent Cost Review**	**~June 2026**
DOE IPR Focused Status Review	**August 5-7, 2025**	**DOE CD-2/3 Approval for Accelerator Rings**	**~Sept 2026**

EIC RRB Meetings

- April 3rd-4th, 2023 - Stony Brook University
  New York, U.S.A
- December 7th- 8th,2023 - Catholic University of America
  Washington, D.C, U.S.A
- May 6th-7th, 2024 - INFN
  Rome, Italy
- November 12th-13th,2024 – BNL
  New York, U.S.A
- **June 5-6, 2025 – Czech Technical University**
  Prague, Czech Republic

EIC Planning Challenges

Challenges:

- To deliver the EIC facility as a single line-item construction project with a constrained and uncertain annual funding profile.
- To control costs as the project is stretched out.
- To retain and promote engagement of partners in final design and construction.

Status:

- CD-0, Mission Need, approved 2019, and CD-1 approved 2021. CD-1 cost range is $1.7B to $2.8B, with peak annual funding assumed to be $325M/year in FY2026. FY2026 PBR for EIC is $113M.
- CD-2/3 for the Accelerator Rings and CD-2 for the Detector are planned for end of FY2026.

Assessments of Baseline Readiness

Assessments of baseline readiness for each subproject will measure status and evaluate future work needed to be ready for a DOE CD-2 IPR. The charge for these reviews includes **technical, cost, schedule, and management**. The charge will also evaluate plans to design to cost.

Director's Reviews will be completed by the end of 2025:

Electron Injector Complex – *Review Completed*	April 8-10, 2025
Co-Chairs: T. Raubenheimer, SLAC, MAC Chair & E. Peoples-Evans, ANL, APS-U PM.	
Detector	November 12-14, 2025
Co-Chairs: A. White, UTA, DAC Chair & S. Nahn, FNAL, USCMS PM.	
Interaction Region	November 18-20, 2025
Co-Chairs: O. Bruning, CERN, HL LHC PM, & R. Carcagno, FNAL retired, HL LHC AUP LHC Deputy PM.	
Accelerator Storage Rings	December 2025
Co-Chairs: TBD	
Global Project and Energy & Luminosity Ramp-up (TBD)	December 2025

EIC Project Priorities

- Execute the CD-3A long lead procurements within acceptable cumulative schedule and cost metrics and start executing CD-3B procurements.
- Elaborate all the scope necessary for the EIC facility in the “EIC Portfolio.”
- Conduct director’s reviews to assess status of CD-2 preparations for each subproject and prepare the accelerator rings subproject and detector subproject for baseline approval in 2026.
- Start RHIC Removal & Repurposing work after RHIC run concludes.
- Prepare for the DOE reviews required to start EIC construction in 2026:
  - CD-2/3 Accelerator Storage Rings – Integrated with RHIC decommissioning plans.
  - CD-2 Detector (ePIC) – Important to align community engagement and in-kind plans.

Project Risks – Big Picture

EIC will be a U.S based, international user facility. The only collider to be built in the coming decades, advancing accelerator and detector science and technology. There are risks that will need to be mitigated to realize EIC project and programmatic goals.

- Funding – Annual project funding must ramp-up to support EIC construction.
  The transition from RHIC operations to EIC construction provides an opportunity.
- Schedule – The delay in ramping-up funding can result in a loss of a schedule imperative or schedule driver. Successful projects are driven by schedule performance goals.
  Critical decisions for subprojects should be helpful, and efficient transition from RHIC operations into EIC construction.
- Cost – Longer schedules usually mean higher costs.
- Research Support – The EIC project and research program depends on supported by scientific personnel. Increased funding for research support is needed.

Opportunities

- Baseline (CD-2) and Construction Start (CD-3) of the Accelerator Storage Rings, and Baseline (CD-2) of the Detector will require DOE approved funding profiles.
- CD-2 and CD-3 goals provide performance imperatives.
- There is an increase in international and domestic interest in technical contributions to the accelerators and detector.

Summary

- It is time to for the EIC project to transition from preliminary design into final design and construction.

- The “Assessment of Baseline Readiness” for the EIC detector, ePIC, in November 2025 will provide a comprehensive assessment of the project plans. It is important that this review is strongly supported by the project and the ePIC collaboration.

Questions?

EIC Project Highlights

Major Project Milestones
- CD-3A Long Lead Procurement (LLP) of $90M approved in 2024 and most contracts already awarded.
- Successful DOE CD-3B/Status review in Jan 2025.
- CD-3B LLP of $66M ready for ESAAB approval.
- Preparation of “EIC Portfolio” led by Erik Johnson.

Reviews, Boards, and Advisory Committees in 2025
- Advisory Board meets 3-4 times annually.
- Resource Review Board meets 2x each year.
- Advisory Committees (PAC, MAC, DAC, ICAC).
- IR SC Magnet Steering Group meets at least monthly.
- Electron Injector Design & Cost Review in April.
- “Red Team Review” in May 2025 – Focus on project delivery strategy via sub-projects.
- DOE “Focused Review” on August 5-7, 2025.

Infrastructure
- $100M New York State Grant for EIC buildings.
- 90% Detailed Design submission received in April 2025.
- A/E preparing conceptual design for e-injector complex.

Accelerator
- Reuse of Advanced Photon Source magnets processed at BNL and JLab.
- Optimized design and scope to mitigate risk.
- Electron injector design changed to remove Rapid Cycling Synchrotron (RCS) from RHIC tunnel.
- International EIC Accelerator Collaboration established and working groups established.

Detector
- R&D complete
- ePIC Detector technical baseline defined and Preliminary Design Report in preparation.
- Assessment of Baseline Readiness planned for Nov 2025.
- Plans developing for the EIC Science Program.

RHIC to EIC Transition
- DOE ONP Review of RHIC Operations in the EIC era planned for September 2025
- RHIC Operations planned to conclude end of 2025.
- Removal & Repurposing planned for January 2026.