Host labs' computing support for EIC

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The EIC computing landscape

With one experiment and DOE components only

Co-host Lab: JLAB

Need to support EIC computing and users

**Co-host Lab: BNL**

Need to support EIC computing and users

EIC project

Computing is not part of the EIC project.
But it needs simulations (e.g. , computing) for its detector (and accelerator) optimization.
The project will terminate with CD-4

ePIC collaboration

Elaborates its computing model.
Needs simulations (computing) for detector simulation and other services provided by Labs
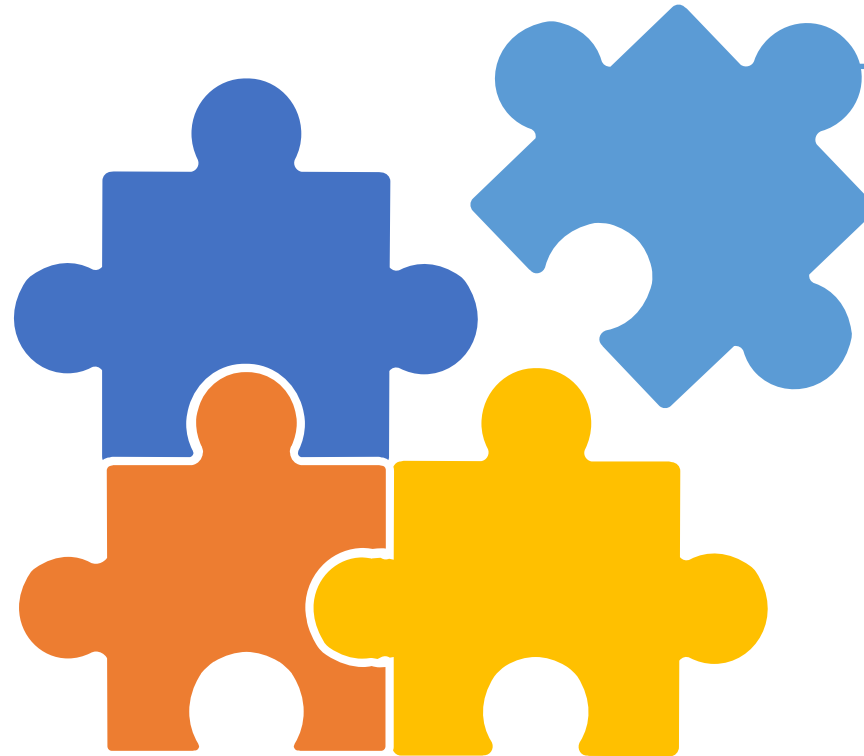
EIC environment from Computing & Software perspective

The host Labs: BNL & JLAB

Supply services, infrastructure

Complementary strengths

The EIC project

Makes sure EIC as a project (accelerator and detector 1) delivers on time and within budget

The project ends with CD-4

Computing and Software are not part of the EIC project (DAQ is)

The ePIC collaboration

The scientific collaboration around Detector 1

Computing and Software coordinators

- Organize collaboration efforts and requirements
- Define a computing model

Interface with the ECSJI

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The Partnership

- Brookhaven National Laboratory (BNL) and Thomas Jefferson National Accelerator Facility (JLab), as host labs for the Electron-Ion Collider (EIC), have established a collaborative entity, the EIC Computing and Software Joint Institute (**ECSJI**). This joint entity is designed to support the computing and software needs and activities of the EIC.

- ECSJI will leverage **complementary expertise at the two labs**, providing essential visibility to respective lab management and stakeholders. The advantages of such a structure also include increased reliability and availability of resources for the ePIC collaboration and other potential future collaborations.

- The success of the EIC, an international scientific endeavor, will benefit from contributions from international partners towards its computing effort.

- To facilitate efficient coordination, the Institute will oversee the EIC International Computing Organization (**EICO**), encompassing all contributors to the EIC computing effort.

> *This institution is set up with the mid-term and long-term in mind, as there are currently no programmatic resources for EIC computing at the two Labs.*

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The Scope

The Institute will provide for EIC computing and software matters:

1) A single entity to interface with the EIC project, the ePIC collaboration, theoreticians, and future collaborators.

2) Execution of host lab responsibilities.

3) Maintenance of service level agreements and statements of work outlining the *two* host labs' contribution to the ePIC collaboration concerning computing resources, services, and personnel assigned to work on ePIC computing and software deliverables.

4) A coordinating body for interacting with international partners, providing computing resources as in-kind contributions, including:

   – Assessing resources.

   – Managing the agreements with the sites delivering resources (including service levels).

   – Facilitating and assessing the delivery against the agreements.

The scope may evolve over time and the organization of the institute as well.

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Organization & Governance

- The Institute aims to efficiently support the EIC while recognizing organizational differences at the two labs.

- The proposed governance model ensures robust support for EIC experiments, accelerator simulations, and theoreticians in computing and software matters. It also involves monitoring the Institute's performance with clearly defined reporting mechanisms.
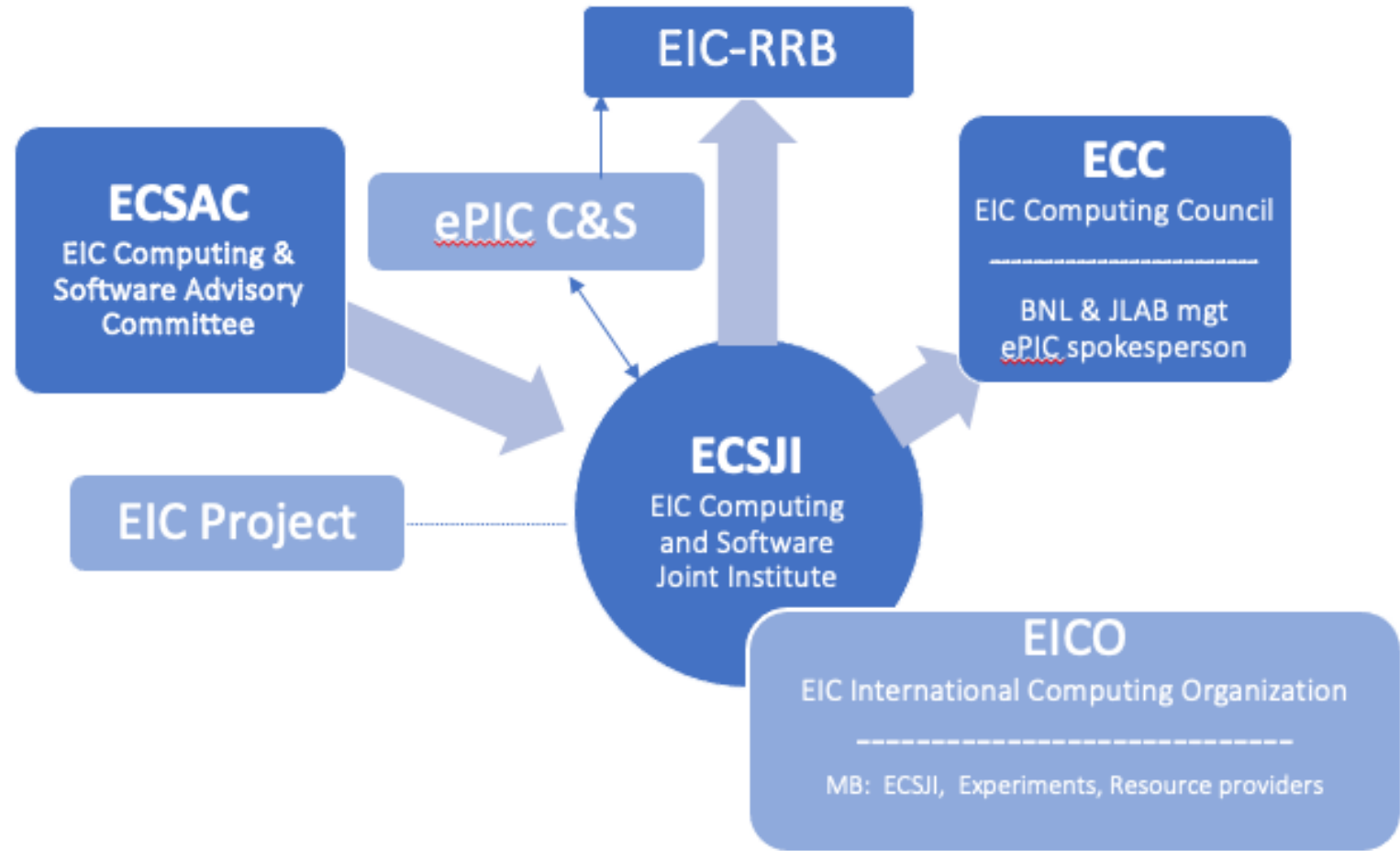
The proposed governance structure is composed of two central bodies, designed to facilitate communication, coordination, escalation of issues, and conflict resolution.

Proposed - Host Labs responsibilities

Oversight for ePIC software and computing designs and execution to provide assurance functions for the host labs and DOE.

Provisioning and operating standard infrastructure solutions consistent with supported lab infrastructures and community best practices.

Support for the EIC International Computing Organization (EICO).

Interface for local resources and policies at the respective labs.

Ongoing computing operations in support of the accelerator and detector design and construction.

Operational support functions for:

- Experimental data curation and analysis preservation.
- First-pass processing.
- Data analysis.
- Support of collaboration(s) and users.
- Accelerator and detector simulations and theoretical calculations.

Institute Management

Composition: Management will comprise two co-directors, each nominated by one lab. The co-directors are currently Eric Lancon (BNL) and Amber Boehnlein (JLab).

Reporting: The Institute's management will report jointly to two host labs management.

Duties and accountability:

- The management will be responsible for organizing the Institute to deliver on the previously defined responsibilities.
- The management will maintain a multi-year operation plan for the host labs, providing matrixed staff members to support activities.
- Institute management will provide a yearly report to the host labs' management.

Regular meetings are organized with

- ePIC management and ePIC computing coordinator
- EIC co-directors of the experimental program

EIC Computing Council

The ECC is chaired in alternation by the Associate Laboratory Director for Nuclear and Particle Physics of BNL and the Deputy Director for Science of JLab. It comprises the ALDs/ADs and deputies involved in the EIC science program and Institute management. The ePIC collaboration spokesperson or deputy is an ex officio member.

- **Responsibility**: Review the ECSJI strategic direction and support leadership in managing effective interfaces of the ECSJI to the EIC project and ePIC collaboration.

- **Authority**: Approve the ECSJI strategic direction, leadership changes, annual budgets, resource allocations, and performance milestones.

Additional proposed responsibilities:
- Oversee the development and implementation of EIC Computing and Software and review future computing needs.
- Oversee synergies between the host Labs in EIC scientific computing area and provide institutional strategic direction.
- Resolve high-level issues between stakeholders.
- Meet at least twice a year and hear reports from Institute management.

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The Institute was created fall of 2023

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The EIC Computing and Software Joint Institute (ECSJI)

Brookhaven National Laboratory (BNL) and Thomas Jefferson National Accelerator Facility (JLab), as EIC host Labs, are creating a joint structure, the EIC Computing and Software Joint Institute (ECSJI), incorporating parts of BNL and JLab facilities to support the EIC and computing and software needs and activities. ECSJI will leverage complementary expertise at the two Labs and provide needed visibility to the respective Lab management and stakeholders. The advantages of such a structure also include increased reliability and availability of resources for the ePIC collaboration.

The success of the EIC, an international scientific endeavor, will benefit from contributions from international partners towards its computing effort. To facilitate efficient coordination, the institute will administer the EIC International Computing Organization (EICO), which will include all the contributors to the computing effort.

Scope of the EIC Computing and Software Joint Institute
This institute will provide for EIC computing and software matters:
1) A single entity to interface with the EIC project and the ePIC collaboration,
2) Maintains Service Level Agreements and statements of work outlining the host labs' contribution to the ePIC collaboration concerning computing resources, services, and personnel assigned to work on ePIC computing and software deliverables,
3) A coordinating body for interacting with international partners providing computing resources as in-kind contributions. This includes assessing resources, managing the MOUs with the sites delivering resources (including service levels), and facilitating and assessing the delivery against the MOUs,
4) Execution of host Lab responsibilities as detailed below.

Organization & Governance
The institute aims at providing efficient support to the EIC while acknowledging the differences in the organization at the two Labs. The proposed governance model ensures that the EIC experiment(s) are well supported in matters of computing and software, the institutes' performance is monitored, and reporting is clearly defined.

The Institute Management
- *Composition:* the management will comprise two co-Directors; each is nominated by one Lab. The co-directors are currently Eric Lancon (BNL) and Amber Boehnlein (JLab).
- *Reporting*: the institute's management will report jointly to the two host Lab management.
- *Duties and accountability*:
  o The management will be responsible for organizing the institute to deliver on the responsibilities defined above.
  o The management will maintain a multi-year operation plan for the host Labs, providing matrixed staff members to support the activities.
  o The management will provide a yearly report to the host Lab's management.

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Responsibilities
The Host Lab's Responsibilities
The primary technical responsibilities of host Labs include and are not limited to the following:
- Oversight for ePIC software and computing designs and execution to provide assurance functions for the host Labs and DOE,
- Provisioning and operating standard infrastructure solutions consistent with supported Lab infrastructures and with community best practices,
- Support for the EICO,
- Interface for local resources and policies at the respective Labs,
- On-going computing operations in support of the accelerator and detectors design and construction,
- Operational Support Functions for:
  o Experimental data curation,
  o First-pass processing,
  o Data analysis,
  o Support of collaboration(s) and users,
  o Accelerator and detector simulations.

ePIC Collaboration Responsibilities
The ePIC collaboration responsibilities include and are not limited to the following:
- Developing and documenting a cost-effective computing model tailored to the experiment's needs, with the concurrence of the host Labs,
- Developing and maintaining multi-year resource plans,
- Report ePIC status in computing and software to the EIC-RRB,
- Identifying with input from the host Labs, a Computing and Software coordinator who serves as Point of Contact to ECSJI,
- Developments of Software Algorithms,
- Production operations.

Haiyan Gao
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Haiyan Gao
Associate Laboratory Director
Brookhaven National Laboratory

David J. Dean
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David J. Dean
Deputy Director for Science
Jefferson Lab

EIC Computing and Software Advisory Committee

The **ECSAC** is chartered to propose advice, guidance, and counsel on the strategy and objectives of the Institute and of the EIC International Computing Organization.

The committee reports to the ECSJI management. The ECSAC chair and committee members include external managers and experts in the field appointed by Institute management in consultation with host lab management. It will meet at least twice a year.

Proposed responsibilities:

- Review the strategy and objectives of the Institute to support EIC Computing and Software.
- Evaluate the adequacy of the infrastructure and resources to meet the computing requirements of the ePIC collaboration.
- Evaluate proposed technical solutions and their implementation.
- Identify opportunities to increase effectiveness and efficiency.
- Provide recommendations on technical and organizational matters.
- If conflicting requirements affect operation, planning, or budget, the ECSAC will be asked to provide recommendations.

EIC Computing and Software Advisory Committee

Current members:

Mohammad Al-Turany (GSI)

David Brown (LBNL)

Simone Campana (CERN)

Pere Mato (CERN)

Christoph Pauss (MIT)

Heidi Schellman (U Oregon)

Frank Wuerthwein (UCSD)
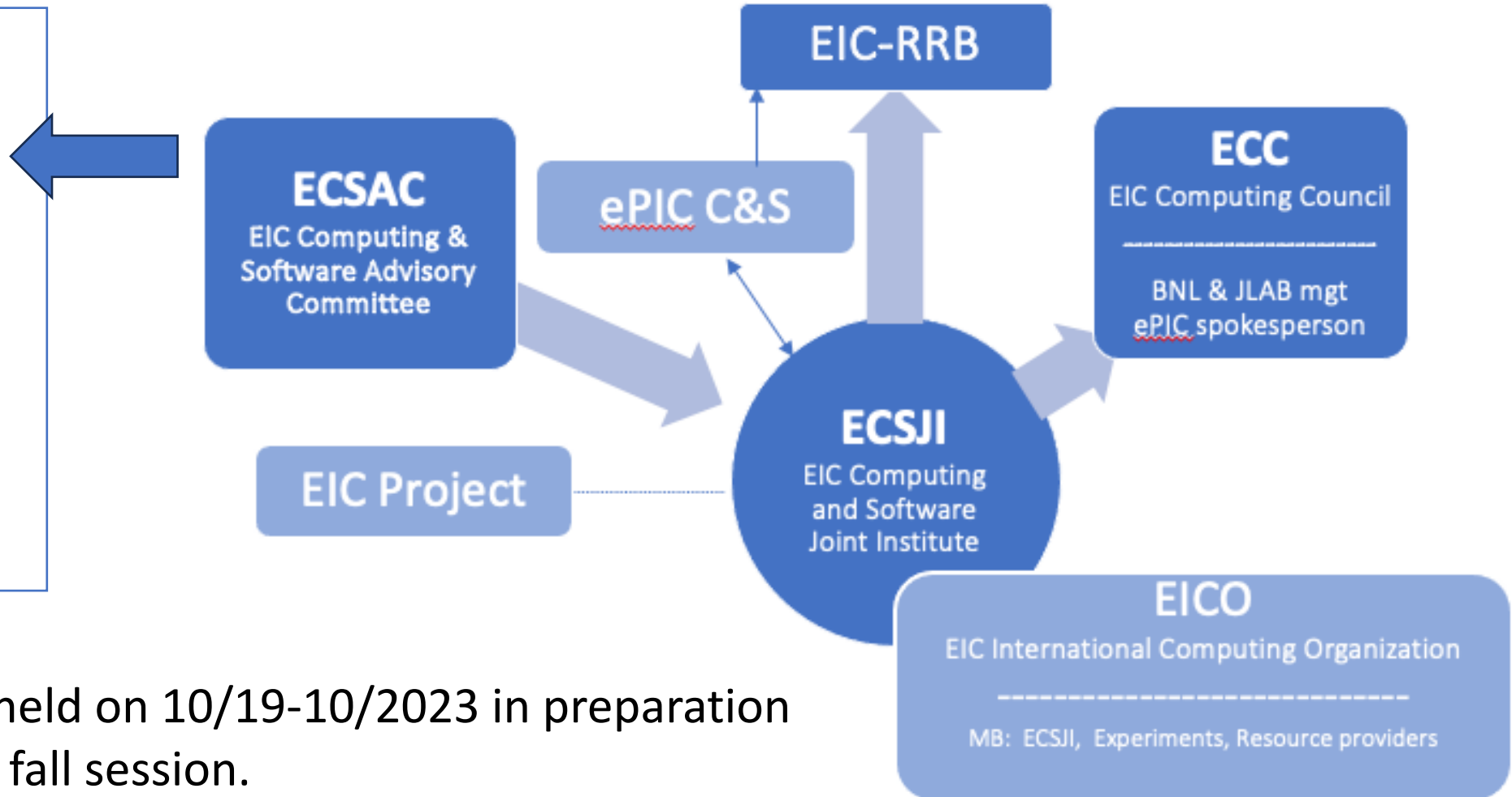
- The first review was held on 10/19-10/2023 in preparation for the 2023 EIC-RRB fall session.
- A second one will be organized in early fall once ePIC has elaborated more on a quantitative computing model.

The recommendations from the fall 2023 ECSAC review

Recommendations:

We recommend that ECSJI verify the readiness of simulation and reconstruction for the TDR by May 2024.

We recommend that ePIC document a first computing needs assessment by the next ECSAC review, in roughly one year.

Recommendations:

We recommend that the ePIC collaboration start by the time of the next year's ECSAC review an evolving list of software dependencies that includes the packages, who the primary supporters are, and what the ePIC collaboration contributes to them.

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EIC International Computing Organization

- The EICO is led by the Institute's co-directors and administered by the ECSJI. Its purpose is to provide computing resources and infrastructure to the ePIC collaboration and potentially address other computing needs related to the EIC.

- **As the EICO becomes established, its structure will be formally documented in an EICO charter.** The EICO is managed by a board that includes representatives from ePIC and international partners. The board will convene at least quarterly and receive regular reports from the ePIC experiment.

- *Proposed responsibilities:*
  - Document and maintain agreements with international contributors to EIC computing.
  - Collect requirements from the ePIC collaboration.
  - Produce accounting reports of EIC computing.
  - Accounting report to the EIC Resource Review Board (EIC-RRB), detailing service delivery with respect to agreements.
  - Supervise service level agreements.
  - Propose ECSAC members.

To be setup

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EICO mid-term

- ECSJI and ePIC management will collaborate to define 'external partners' for inclusion in the upcoming EICO charter. The charter will cover key aspects such as
  - service quality standards,
  - specific functionality criteria,
  - contribution size,
  - and a formal procedure for external partner inclusion and validation.

- The EIC is already using the Open Science Grid (OSG) and anticipates including significant external partners from WLCG-affiliated institutions.

- We expect to integrate and leverage software, tools, and services developed by the WLCG community into EIC computing operations
  - Over the coming year, the ECSJI plans to apply for observer status to the WLCG

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Computing resources for the EIC

- Presently, support and resources for the EIC at BNL and JLAB are provided opportunistically.

- Limited local funding is available at both Labs for computing and development.

- BNL and JLAB collaborated on the long-term planning of the Nuclear Science Advisory Committee (NSAC), emphasizing the substantial increase in computing requirements anticipated before the turn-on of the EIC in the coming years.

- Limited funding specifically allocated to EIC computing is not expected to begin before FY25 the earliest.

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THANK YOU

Proposed computing agreements timeline

2024
- ePIC to develop a comprehensive quantitative computing model
- Identify possible international contributors
- Work on the EICO Charter
- Work on agreements legal content, Identify signing authorities in various countries
- Establish accounting mechanism for contributions to EIC computing

2025 - 2026
- Resource planning for the short and long-term
- Refinement of ePIC computing model and requirements

2027+
- Finalize agreements legal content
- Start agreements signing process

2029+
- Agreements are signed
- International contributions included in eventual EIC Full dress rehearsals

Year-0
- Data Taking

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EIC Schedule

CD-3A/3B:

Approve start of long-lead procurements
CD-3A items passed final design review
All interfaces related to them are frozen
Waiting for ESAAB meeting for authorization

CD-2:

Approve prelim. design for all subdetectors
Design Maturity: >60%
Need "pre-"TDR (or draft TDR)
Baseline project in scope, cost, schedule

CD-3:

Approve final design for all subdetectors
Design Maturity: ~90%
Need full TDR
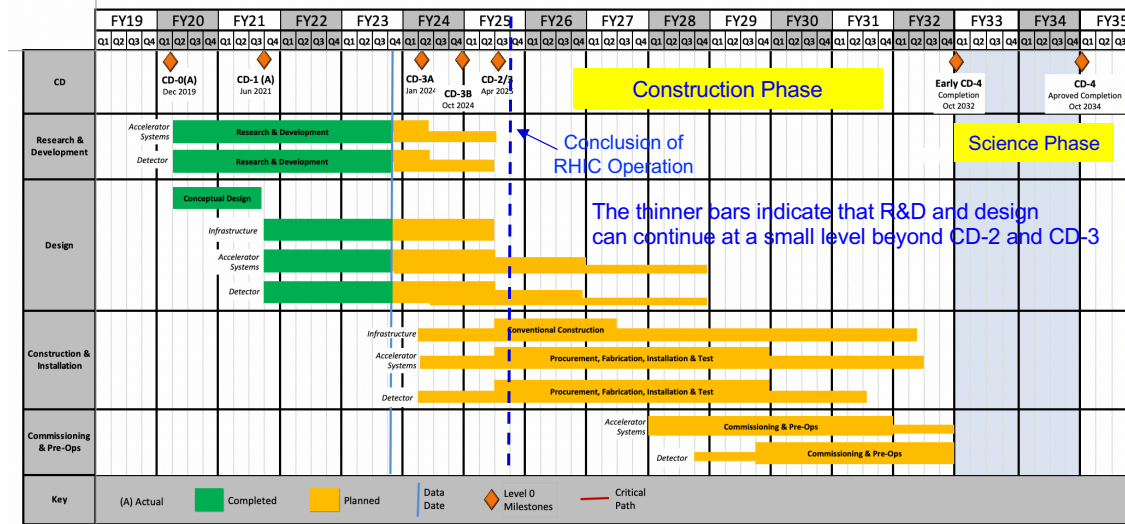
EIC Critical Decision Plan	
CD-0/Site Selection	December 2019 ✓
CD-1	June 2021 ✓
CD-3A	January 2024
CD-3B	**October 2024**
CD-2/3	**April 2025**
early CD-4	October 2032
CD-4	**October 2034**

Speculation based on EIC accelerator project status, on still uncertain FY24 and FY25 budget scenarios, and projected RHIC FY24 run:

• CD-3B Approval Dec. 2024

• RHIC operations conclude at end of FY25, in September 2025

• CD-2/3 Approval Dec. 2025, Possibility of CD-3C as needed.

Electron-Ion Collider

E.C. Aschenauer & R. Ent

Courtesy
E.C. Aschenauer (BNL)
R. Ent (JLab)