**PARTNER LOGO HERE**



**Project Planning Document**

**between**

**Brookhaven National Laboratory**

**(“BNL”)**

**and the**

**<Partner Institution>**

**for Participation in**

**The Electron-Ion Collider Project**

**(“EIC”)**

**Part 1: Project Management**

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# CHANGE LOG

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# Preamble

The Electron-Ion Collider (EIC) Project is a U.S. Department of Energy (DOE) project and it will incorporate significant in-kind contributions from international funding agencies, research institutions and universities (hereinafter referred to as “Partners”). These contributions provide an opportunity to bring expertise and resources into the Project from outside of its host laboratory, Brookhaven National Laboratory (BNL), and DOE.

The EIC Project baseline is expected to be based on an anticipated scope of deliverables from the international Partners for the construction phase defined via non-binding instruments and other planning documents in advance of project baselining by DOE, Critical Decision 2 (CD-2). The final confirmed scope of work for the EIC construction phase is expected to be documented in appropriate legal instruments between DOE and individual Partner agencies, in advance of the start of construction, CD-3, approved by DOE.

The purpose of this Project Planning Document (PPD) is to describe mutual understandings between BNL and <partner agency> (hereinafter referred to individually as a “Participant” and collectively as the “Participants”) regarding the Scope of Work (SoW), deliverables, and conditions of acceptance of the planned in-kind contribution to the EIC Project of <partner institution>, as outlined in the Statement of Interest (SoI) or relevant implementing arrangements between DOE and the <partner agency>. The PPD is jointly developed between Brookhaven National Laboratory and the <partner institution>, and consists of two parts:

**The PPD – Part 1** describes the management and oversight structure, EIC Review Plan, Project Phases

and Project Management principles applicable to the <partner institution> proposed in-kind contribution

to the EIC Project. These principles are mutually understood as the requirements and specifications of

Project Management.

The **PPD – Part 2** describes the SoW required to complete the proposed contribution by the <partner institution> to the EIC Project which includes components and technical documentation. It covers a technical description of the deliverables, project activities, schedule and key milestones.

The PPD documents are intended to complement any planning instruments and/or implementing arrangements completed by the time of CD-2 and to define the SoW necessary to support project baselining at CD-2, authorization of construction at CD-3, and project completion at CD-4. It is understood that activities performed by the Partners of the EIC Project are such that all Partners recognize that the success of the EIC Project depends on each adhering to the proposed plans described in the PPD documents. Furthermore, it is understood that PPD – Part 2 is to be updated, as needed, to maintain conformity with any applicable international agreements that are anticipated to be in place in advance of CD-3.

The SoW described in this PPD is intended to contain an appropriate level of detail so as to permit the Participants to clearly understand the work that is planned, the duration of the work involved, and the deliverables and the conditions of their acceptance, subject to the relevant legal instruments referenced in Section 2.2.

The PPD documents have been negotiated between BNL and the above-listed Partners during 2019 and 2020 as part of joint preparations for CD-2. This PPD provides an easy source of reference for project stakeholders on the high-level interdependencies between and among the Partners and how these are expected to be managed.

# The EIC Project

EIC will design, build, and install the accelerator hardware for a new electron storage ring, an electron injector, and modifications to the hadron ring required to produce an electron-ion collider. The project will leverage the accelerator tunnels and related existing buildings constructed for the Relativistic Heavy Ion Collider (RHIC). Smaller buildings will be added outside of the berm and tunnel profile and will house power supplies serving magnet systems within the tunnel. The two largest EIC buildings will house the electron injection linear accelerator (“Linac”), the electron gun and related laser equipment, as well as the Radio Frequency (RF) power supplies to Linac RF cavities. EIC will include one Interaction Region (IR), with an allowance for a second, and one detector. The facility is designed to ensure high reliability and availability for the user program. In-kind contributions from domestic and international collaborators (including New York State) are being finalized. The EIC Project is responsible for the design, construction, installation, and commissioning of all its parts mentioned above, including those that are delivered by international participations. EIC is organized as a DOE project subject to DOE Order 413.3b [[1](#_References)], managed by BNL, incorporating contributions from international Partners. BNL retains the direct responsibility for the successful completion of the EIC Project, under the direction of the DOE Office of Science.

## EIC Project Scope

The scope of the EIC Project is described in the Conceptual Design Report developed for CD-2 [2]. All work is specified in a Work Breakdown Structure (WBS), as described in the EIC Project Management Plan [3]. The division of scope among the international Partners is developed by the senior management of the EIC Project under general guidance from the participating funding agencies.

The EIC takes advantage of the entire existing Relativistic Heavy Ion Collider (RHIC) facility with only a few modifications at a relatively small cost on the scale of the project. The EIC design must satisfy the requirements of the science program while having acceptable technical risk, reasonable cost, and a clear path to achieving design performance after a period of initial operations. The EIC design is the result of a design strategy which takes all these requirements into account.

BNL, as the host laboratory, is directly responsible for the entire EIC Project, including the design, construction, installation, commissioning and operation of all hardware, software, the facilities, and infrastructure that support the scope of the Project, as follows:

* Hadron Storage Ring (HSR), to be built by maximizing the re-use of RHIC hadron rings components;
* Electron Rapid Cycling Synchrotron (RCS);
* Electron Storage Ring (ESR);
* High luminosity Interaction Region (IR);
* One Detector and its equipment;
* Infrastructure systems necessary to enable installation and operation of the particle accelerator, storage rings, and target instruments.

BNL plans to collaborate with international Partners in designing and building these facilities.

## International Agreements

The division of responsibilities is planned to be documented in international agreements between DOE and individual partner agencies.

The division of scope among all international partners during the construction phase of EIC is expected to be delineated in advance of CD-2 and formalized in advance of CD-3. It is further understood that any assignments of responsibility are to be determined by the collaborating institutions based on factors such as the capabilities and interests of each institution, maturity of negotiations towards formal agreements, and/or significant involvement in the design or R&D of a particular system.

# Document Scope

The PPD – Part 1 describes the management and oversight structure, EIC Technical Review Plan, project Phases, and Project Management principles applicable to the <partner institution> in-kind contribution to the Electron-Ion Collider Project. These principles are considered as the specifications of Project Management. PPD – Part 1 and PPD – Part 2 are intended to complement relevant planning instruments and/or implementing arrangements and to comprise a complete set of plans, allowing the <partner institution> to clearly identify the SoW necessary for the management of the (in-kind contribution) project.

All other Partners to the EIC Project are expected to collaborate subject to a PPD-Part 1 with BNL in substantially the same form and content as this PPD-Part 1.

# General Provisions

The provisions of this PPD – Part 1 [and its Appendices] are without prejudice to relevant international agreements and/or separate written agreements between BNL or DOE and <partner institution> (or its governmental authorities) as they may mutually decide to conclude concerning involvement in or contributions to the EIC Project. In the event of any conflict between the provisions of this PPD – Part 1, on the one hand, and the international agreements or separate written agreements referenced in Section 2.2, on the other hand, the latter are intended to prevail in accordance with their stated order of precedence.

Except as otherwise specified in writing by the Participants, each Participant is responsible for the costs it incurs in participating in the activities identified in this PPD – Part 1.

Each Participant’s participation in the activities contemplated by this PPD – Part 1 is subject to the availability of appropriated funds, personnel and other resources.

Each Participant intends to conduct the activities contemplated by this PPD – Part 1 in accordance with applicable laws, regulations and procedures to which it is subject, and applicable international agreements

to which its Government is party.

This PPD – Part 1 does not create any legally binding obligations between the Participants.

# Related Documents

## Project Planning Document – Part 2

This PPD – Part 1 is accompanied by the following associated document:

* PPD – Part 2 “<In-Kind Deliverable>”

## Technical Documents

The PPD – Part 2 contains a list of technical documents applicable to the specific SoW planned with the partner institutions. Any change of the technical documents is to be managed through the Configuration Management Plan [4].

##  Project Management Documents

Project Management documents are applicable to all project tasks and phases. They are legally non- binding documents, mainly for informational purposes where it is understood that the Partners intend to follow the provisions of the document.

The project management documents include, but are not limited to, the following:

* EIC Project Execution Plan (PEP) [5]
* EIC Project Management Plan (PMP) [3]
* EIC Risk Management Plan (RMP) [6]
* EIC Configuration Management Plan (CMP) [4]
* EIC Quality Assurance Plan (QAP) [7]
* EIC Systems Engineering Management Plan (SEMP) [8]
* EIC Technical Review Plan (TRP) [9]
* BNL ES&H Database [10]
* EIC Integrated Safety Management Plan [11]

PPD – Part 2 may indicate additional project management documents where necessary.

# Terms and Definitions

## Definitions

The following terms and expressions, when used in capital letters in this Part and in associated Parts, have the meaning described below. Any terms and/or expression defined in an applicable international agreement is intended to have the same meaning for purposes of PPD-Part 1 and Part 2, unless otherwise specified in PPD-Part 1 or Part 2.

* **“Participant”:** The signatories to this PPD, i.e., BNL and <PARTNER INSTITUTION>, individually referred to as a “Participant” and collectively as the “Participants.”
* **“Partner”**: Any funding agency, research institution or university contributing to the EIC Project.
* “**In-Kind Contribution (IKC)**”**:** A non-cash contribution provided by a Partner and/or a Participant. It may cover:
	+ Technical components for the EIC Project as well as personnel to perform testing, installation, and/or integration of components;
	+ R&D work as well as personnel performing the work;
	+ Personnel made available for specific tasks during the Construction Phase; and
	+ Other products or services relevant to the completion of the EIC Project.
* **“Components or Services”**: Any hardware, software element, system or sub-system, or services to be provided by <PARTNER INSTITUTION>.
* **“Documentation”**: Any engineering drawings, travelers (being quality control documents), test results and accompanying verification reports, material specifications, components manuals, procurement information for complex deliverables such as vendor qualification criteria, manufacturing inspection plans, and vendor in-process data, and related documents that describe the Component contributions.
* **“<partner institution> Deliverables”:** Any Components, Services and Documentation,to be delivered to the EIC Project by the <partner institution>.
* **“BNL Deliverables”:** Any hardware, software, services, or documentation to be provided by BNL/EIC to <partner institution> for the performance of the SoW defined in this or associated PPD documents. The list includes contributions provided to <partner institution> either by (1): BNL/EIC directly or (2): another Partner through BNL/EIC, if they are required by <partner institution> to perform the SoW as described in this PPD – Part 1 and Part 2.

## Acronyms

For purposes of this PPD, the following list of acronyms are used.

|  |  |
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| **Acronym** | **Definition or Description** |
| **BNL** | Brookhaven National Laboratory |
| **CCB** | Change Control Board |
| **CD** | Critical Decision  |
| **CDR** | Conceptual Design Review  |
| **CMP** | Configuration Management Plan  |
| **EAB** | EIC Advisory Board |
| **EIC** | Electron Ion Collider |
| **EIEB** | EIC In-Kind Contribution Execution Board |
| **EVMS** | Earned Value Management System |
| **DOE** | Department of Energy |
| **FDR** | Final Design review  |
| **ICD** | Interface Control Document |
| **IKC** | In-kind Contribution  |
| **IRR** | Installation Readiness Review |
| **MRR** | Manufacturing Readiness Review  |
| **PR** | Principal Representative |
| **PDR** | Preliminary Design Review |
| **PEP** | Project Execution Plan  |
| **PPD** | Project Planning Document  |
| **PMP** | Project Management Plan  |
| **PRD** | Physics Requirements Document |
| **PRR** | Procurement Readiness Review  |
| **QA** | Quality Assurance |
| **QAP** | Quality Assurance Plan |
| **RLS** | Resource Loaded Schedule |
| **RMP** | Risk Management Plan |
| **SAR1** | System Acceptance Review (Partner Acceptance) |
| **SAR2** | System Acceptance Review (BNL Acceptance) |
| **SEMP** | Systems Engineering Management Plan |
| **SoI**  | Statement of Interest |
| **SoW**  | Scope of Work  |
| **SPC** | Sub-Project Coordinator |
| **SPCL** | Sub-Project Coordinator Leader |
| **SPM** | Sub-Project Manager  |
| **SPML** | Sub-Project Manager Leader |
| **TJNAF** | Thomas Jefferson National Accelerator Facility |
| **TPC** | Total Project Cost to DOE |
| **TR** | Technical Representative |
| **TRP** | Technical Review Plan |
| **TRR** | Transportation Readiness Review |
| **WBS**  | Work Breakdown Structure  |

# Communication, Management, Governance

## Communication and Management Structure

BNL plans to keep a well-defined management interface and regular communication with all the EIC Partners at multiple levels. The communication, management, and oversight structure for the execution of the scope of work contributed by the Partners (described in individual PPDs, Parts 1 and 2, between BNL and each Partner lead or funding agency), is indicated schematically in Figure 7.1.



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**Figure 7.1:** Organization and governance of EIC Partner Institutions and BNL.

The organizational structures of DOE and the Partner agencies for the overall governance of the EIC Project are planned to take roughly parallel forms, with commensurate responsibilities within each level. Figure 7.1 also identifies the interfaces and the communication scheme among the responsible Partners at each level.

BNL plans to coordinate the work and services with all the Project Partners, each of which is represented through a single point of contact. Any interaction with other Partners is expected to be organized and managed by BNL under general direction and oversight by DOE. <PARTNER INSTITUTION> plans to provide documents, training, and technical assistance to BNL to allow successful integration, operation, and maintenance of equipment in accordance with PPD – Part 2.

BNL plans to monitor technical progress of the production of the IKC, and should be provided with relevant information and data, including monthly progress reports and regular meetings and visits of BNL personnel to the <PARTNER INSTITUTION> site for monitoring and QA. BNL and <PARTNER INSTITUTION> are expected to accommodate engineers, technicians and other experts visiting each other for extended periods, especially during the production phase.

In carrying out Project activities, each Participant has the right to involve subcontractors on such terms as it may specify. The Participants should take appropriate steps to ensure that expectations under this PPD – Part 1 (e.g. QA) also apply to their respective subcontractors, as applicable. The Participants are expected to interact with and manage their subcontractors directly. BNL expects to manage interactions with any other third parties, including other Partners.

The roles, responsibilities, authorities, and accountabilities within the Project organization and management structure are described next.

Level 1: Principal Representatives

Partner funding agencies, as governmental entities of the Partner countries, are represented in the various governing bodies of the EIC Project. Implementing arrangements are typically established between DOE and the Partner funding agency and outline the high-level management structure for activities that are to be undertaken under the agreement and/or its subsidiary agreements. The principal oversight role is assigned to the Principal Representatives – one designated by each agency. If an established implementing arrangement needs to be modified upon mutual written agreement by DOE and the Partner funding agency or in case of any critical difficulties between the agencies involved in the arrangement, interaction at the EIC governance level or at <PARTNER INSTITUTION> and BNL top management level might be organized, if needed, at the request of the Principal Representatives. The Principal Representatives are generally responsible for planning and coordinating cooperative activities, serve and/or chair joint Boards the Resource Review Board (RRB) and the EIC advisory Board (EAB).

Level 2: Technical Representatives

Each Partner Lab Director will appoint a Technical Representative (TR). Delegated from the Partner Lab Director, the TR is the primary point-of-contact for all EIC matters at the Partner institution for the respective scope of work. The Technical Representatives are responsible for the execution of the SoW of Parts 1 and 2 of the PPD, including the collaborative program, schedule, and coordination. In addition, the TR is also responsible for compliance with acceptance criteria and acceptance plan of all the deliverables included in the full scope of work described in the Project Planning Documents. Jointly they constitute the EIC IKC Execution Board (EIEB), an advisory body to the EIC Project Director regarding project-wide planning, coordination and issue resolution. The TR is the unique contact of BNL for all issues concerning the <PARTNER INSTITUTION> In-Kind Contribution (IKC). The Technical Representatives participate as a members of the EIC Technical/Change Control Board, if their respective scope of work is affected.

Level 3: Sub-Project Managers and Sub-Project Coordinators and their Leaders

The scope of work undertaken by <PARTNER INSTITUTION> is naturally organized into several technical areas, which are designated as subprojects. Each of these subprojects is managed by a Subproject Manager Leader (SPML) and Subproject Managers (SPM), which are BNL’s designation, and a Subproject Coordinator Leader (SPCL) and Subproject Coordinator (SPC), which are <PARTNER INSTITUTION>’s designation. The SPCLs and SPCs are appointed by the TRs. On the BNL side, the subprojects are directly aligned with EIC activities and each SPM team, made of SPML and all related SPMs, holds overall responsibility for the technical management of the subproject, including coordination with his/her <PARTNER INSTITUTION> counterpart (SPCL and all SPCs). The BNL and <PARTNER INSTITUTION> laboratory SPM and SPC teams serve as the single point of contact for all technical matters under that subproject. The SPML and SPCL are responsible to the Technical Representative for the execution of the approved plan and deliverables for their particular subproject as described in the PPD. The SPMs and SPCs are expected to maintain close communication in the management of their subproject. SPML and SPCL are expected to communicate and coordinate all SPM and SPC activities. All Subproject managers roles (SPML, SPM, SPCL and SPC) will be defined and used throughout the project life cycle, these roles will evolve as the EIC progresses and they may increase or reduce in number as needed. SPCL and SPC roles can be executed by the same person when is deemed that two layers of management and communication are not beneficial for the Project execution.

Project Management Teams

BNL and <PARTNER INSTITUTION> have independently established their own project management teams to organize and manage the work required to advance the EIC Project at BNL. On the EIC side, the entire project management team, consisting of the Project Director, Technical Director, Project Manager, In-kind Contribution Engineer, Associate Directors, and the relevant System Manager, are engaged in <PARTNER INSTITUTION> activities. The EIC Technical Support and Integration and the EIC Project Office Team will be engaged during all phases of the EIC project IKC execution. In addition, as noted above, the EIC Work Breakdown Structure (WBS) Level 2 and Level 3 Managers generally serve as SPMLs and SPMs within the BNL - <PARTNER INSTITUTION> partnership.

## Governance Structure

The EIC governance approach has two levels (funding agencies and project), corresponding directly to management levels 1 and 2 above. This tiered governance approach is designed to facilitate communication and coordination, allow for escalation of issue and conflict resolution, and provide multi-layered influence and motivation.

1. Oversight Boards Management Level 1

**Level 1 Oversight Boards (Funding agencies of Partner labs)** represent the highest-level governing body for the DOE concerning the EIC:

* **EIC Advisory Board (EAB)** is chaired by the TJNAF Director and advises the BNL Director. The Board is composed of senior leaders of laboratories and institutions making significant contributions to the facility. Observers to Board meetings may include prospective partners with common accelerator science and technology interests, DOE, and other funding agencies. The Board collectively provides advice on the construction of the facility and provides a forum for high-level planning, communication, coordination, and resolution of issues affecting the facility. The Board will address issues affecting scope and/or resource allocation for the EIC Project at BNL and the Partner Labs and optimize EIC Project resources with other Partner Lab activities. The Board will establish and regularly review important “hand-off” milestones between institutions during project execution and at project completion. The Board will be active through EIC Project completion and possibly the construction of a 2nd Interaction Region and detector. Partner Lab Directors jointly review the findings and actions of the Board with the BNL and TJNAF Directors, and initiate adjustments in program direction as needed. The Directors will ensure that issues raised by the Board are addressed in a timely manner.
* **EIC Resource Review Board (RRB)** serves the purpose of providing coordination among the different funding partners during both the detector development and construction phase of the project and during the operations of the experiments that follow. The RRB shall provide oversight of resources utilized for detector construction and planning. The RRB will function as the body that reaches agreement on scope entailed in common projects, as appropriate, which shall be funded by members of the RRB. The RRB will be responsible for annually agreeing on and endorsing detector financial commitments from the members. The RRB will monitor progress toward overall detector funding and construction. At the appropriate time, the RRB will include in its purview common computing needs of the EIC detector(s). The RRB shall consist of one representative from each funding agency supporting institutions who collaborate on the EIC detector(s). In this initial phase, flexibility will be applied to membership on the RRB, with likely contributors to the detectors and experiments being candidates for initial membership. The RRB will be co-chaired by either the BNL ALD for Nuclear and Particle Physics or the TJNAF Deputy Director for Science and a non-DOE funding agency.
1. EIC In-Kind Contribution Execution Board

The EIC In-Kind Contribution Execution Board (EIEB) provides project-wide planning, coordination, communication, and issue resolution during all phases of the project, on all project aspects, including schedule, budget, resources, scope (technical and project management), safety, and performance.

The EIEB:

* Is a forum for integratedSafety*,* Risk, and Quality Assurance Management, including applying a graded approach to resolving non-conformances;
* Evaluates the effectiveness of EIC risk management by reviewing the Project’s top/highest risks and their mitigations;
* The EIEB is notified of all changes to the Project baseline scope, technical performance, cost, or schedule that have been recommended by the EIC Management Team.
* EIEB evaluates changes impacting Partner scope or schedule and makes a recommendation for the Technical CCB and/or the Change Control Board (CCB), that approves or disapproves the change following the procedure reported in the CMP;
* Looks for commonalities and standardization across the EIC project and opportunities to increase effectiveness and efficiencies;
* Is a forum for sharing information (technical, project management), experiences, concerns, and lessons learnt;
* Discusses impact of safety issues or incidents reported across the laboratories, DOE complex, and Partner sites to ensure proper work controls are in place in all areas of the EIC Project; and

The EIEB is an advisory board, chaired by the EIC Project Director, and composed of the Technical Representatives of the EIC Partners. The EIEB differs from the RRB and the EAB as its executive session is dedicated solely to EIC project leadership and to TRs from Partners with PPD in place. In matters that require decision making, the EIEB strives to reach consensus. If consensus cannot be reached, the EIC Project Director makes the final decision.

The EIEB meets at least twice a year, or more often as needed, mostly via videoconferencing. Ad hoc meetings may be held to address special circumstances. In-person meetings are expected to rotate around Partner locations. Meetings typically consist of two sessions: an open session that can be attended by all the EIC collaboration members, and an executive session that is limited to the EIEB.

During the open session, the EIEB receives highlights from project activities and milestones, including:

* Latest achieved milestones and status on upcoming milestones;
* Latest and upcoming design reviews;
* In-Kind agreement status and new updates to existing agreements;
* QA items, lessons learned, including those from ongoing installations;
* Configuration control changes that affect Partner scope;
* Decisions on standardization; and
* Partnership management.

The current membership of the EIEB is described in the EIC Project Governance Document [12].

# EIC Technical Review Process

The EIC Project Execution Plan [5] defines the Key Performance Parameters (KPPs) of the project. The KPPs determine the project high-level requirements specified in the EIC Global Requirements Document [13], which define the physics, performance, and functional requirements for the Project. Those documents specify the system configuration, beam parameters, technical requirements, and operational requirements. The Global Requirements flow down into WBS Level 2 system-specific Global and Functional requirements which define the overall accelerator and detector configuration required to satisfy the Global Requirements Document. These requirements further flow down into *Functional Requirements Documents* (FRD)and *Performance Requirements Documents* (PRD) for the EIC sub-systems and components at an appropriate control level. L2 Managers are the owners of their systems and responsible for ensuring that requirement and interface definitions are developed, controlled, and communicated to the team. Requirements and interfaces for each Partner’s scope are to be mutually developed by BNL and Partners.

The EIC technical activities follow processes outlined in the EIC Systems Engineering Management Plan (SEMP) [8], and are controlled through a series of technical reviews described in the EIC Technical Review Plan (TRP) [9]. The comprehensive set of technical reviews are conducted within WBS L2 Systems to ensure: a) the final achieved performance meets high-level requirements (GRD), system-specific requirements and lower level functional (FR) and performance (PR) requirements, within predefined interfaces and b) the consistent flow-down between Global Requirements and lower level requirements.

Pursuant to the designation provided in the EIC SEMP, Level 2 Managers are the system design authorities and have overall responsibility to develop and maintain a System Design Plan that covers all elements in their L2 system, and to assure design reviews are conducted for sub-systems within their respective authorities. In the event that <PARTNER INSTITUTION> takes the leading role to produce a design, <PARTNER INSTITUTION> is expected to become the Designer of Record for such scope of work. The roles and responsibilities of the Designer of Record, as defined in the SEMP, include planning and executing the series of reviews for its scope of work, in accordance with the project SEMP and TRP. This is to ensure a consistent approach to all technical reviews conducted across the entire EIC scope of work.

<PARTNER INSTITUTION> in collaboration with BNL develops a Design Review Plan for its scope of work. The plan includes Review milestones and associated deliverables for each review. The Design Review Plan is subject to approval by the corresponding L2 Manager and the project Technical Director. The detailed list of document deliverables for each review class is a *Partner Deliverable,* integrated in the Project Planning Documents and attached in Appendix A of the associated PPD – Part 2 “<in-kind deliverable>.” BNL plans to assist with organizing the reviews. *With respect to the review process*, the <PARTNER INSTITUTION> Technical Representative role and responsibilities are equivalent to those of a Review Committee Chair, as defined in the EIC Technical Review Plan [9].

The list of all design reviews is reported in the EIC TRP, including the expected design maturity value defined in the TRP and a summary of their objectives, is provided below. The Partner’s role in each review is highlighted as appropriate.

### Conceptual Design Review [30% Design Maturity]

The Conceptual Design Review (CDR) is held to ensure that the objectives and requirements of the design are understood and that the proposed design approach meets these requirements. The emphasis is placed on the requirements, how they flow down, the proposed design concept, and the definition of the major system interfaces. <PARTNER INSTITUTION> to successfully conclude the CDR process has to demonstrate full understanding and validation of: Design Objectives, Requirements and Interfaces, R&D plans, Preliminary hazards analysis and prevention, Risk mitigation and lastly Conceptual estimates of budget and schedule.

BNL holds ultimate responsibility for requirements documents, although they are jointly developed and approved by both BNL and <PARTNER INSTITUTION>. Once approved, these are controlled documents.

### Preliminary Design Review [60% Design Maturity]

Preliminary Design Reviews (PDRs) are technical reviews intended to assure the design meets the requirements and supports a high confidence estimate of scope, cost, and schedule. Designs should be sufficiently advanced to demonstrate compliance with requirements and support an engineering cost estimate. In cases of significant complexity or potential cost or schedule impact, a PDR (or FDR, next section) may be required to guide fabrication or procurement of pre-production prototypes, engineering demonstration units, etc. <PARTNER INSTITUTION> is to demonstrate the design approach meets the technical requirements and satisfies all required interfaces. The completion of the PDR and the closure of any requests for action generated by the review establish the basis for proceeding with the detailed design. The completion of the PDR and the response to recommendations generated by the review establish the basis for proceeding with the final design phase.

### Final Design Review [90% Design Maturity]

Final Design Reviews (FDRs) are technical and programmatic reviews conducted to give assurance that the completed design achieves all requirements, satisfies all interface requirements, and ensures that fabrication and/or procurements are ready to proceed with minimum risk of change orders. In cases of significant complexity and/or cost, an FDR may be required to guide fabrication or procurement of pre-production prototypes, engineering demonstration units, etc.

<PARTNER INSTITUTION> plans to provide assurance that the completed design of the selected configuration meets all functional and performance specifications as well as interfaces.

### Procurement Readiness Review

Procurement Readiness Reviews (PRRs) are reviews held prior to initiating the procurement cycle of critical, high-value, or other procurements. This final check ensures that the appropriate level of technical review has occurred, that the procurement documentation package, in particular Statement of Work (SoW) and Specification documents are complete and satisfies requirements, and that the procurement and technical teams are aligned to accomplish major procurements prior to formal solicitation. For an In-Kind Contributor (IKC), a PRR will consist of a review of the technical documents only. <PARTNER INSTITUTION> plans to demonstrate that the schedule, assessment of planned vendor evaluation, and technical documents are sufficient to execute the procurement and manufacturing cycle.

### Manufacturing Readiness Review

Manufacturing Readiness Reviews (MRR) may be required prior to the start of component manufacture. MRRs are required prior to component manufacture where changes occur to designs, specifications, or requirements following FDR. This can occur for example when a change is identified which improves manufacturability. MRRs are not required for all system, subsystem, and components, but should be conducted for complex, high-risk, or highly technical system, subsystem, and components and included as milestones at the discretion of the System Manager. MRRs are valuable when design improvements for manufacturability are identified post-FDR. MRRs also ensure the fabrication effort produces what the project requires using the latest technical information. The successful conclusion of an MRR authorizes component manufacturing to begin.

### Transportation Readiness Review

Transportation Readiness Reviews (TRRs) are held to ensure that sensitive equipment can be safely transported both onsite and from production facilities (partner laboratories and institutions, industrial partners, IKC, etc.) to BNL or other designated facility. TRRs should be held for complex or delicate devices where standard packaging/crating considerations are inadequate (e.g., cryomodule transport). The review should be scheduled with enough time before the end of production (start of transportation) to allow the final design, review, and fabrication of appropriate transportation fixtures, shipping frames, and other required equipment. In some cases, a separate design cycle with milestone reviews may be required for the shipping tooling depending on complexity. As part of the review, <PARTNER INSTITUTION> plans to provide technical clarifications and/or details as needed.

### System Acceptance Reviews

System Acceptance Reviews (SAR) enable the transfer of ownership and technical risk associated with Partner deliverables from Partners to BNL. SARs are used for all IKC deliverables and may be utilized for other scope as well (though acceptability of components procured under contract is typically addressed through the inspection process or contractually required factory acceptance testing). SARs occur in two phases and are defined as SAR1 and SAR2 with each identified by the milestone in the schedule. Prior to delivery to the project, each IKC, with the support of the cognizant System/L2 and Subsystem Managers, will conduct a SAR1 to allow the project to formally review and accept the deliverable. At the completion of the SAR1, the IKC confirms the deliverable meets all technical specifications, requirements, and acceptance criteria, and that all documentation is complete. The EIC Project also confirms that the documentation is complete and authorizes the IKC to ship.

The Project conducts a SAR2 after an IKC deliverable arrives at BNL (or other designated location) for integration, and confirms that the deliverable meets all technical specifications, requirements, and acceptance criteria after transportation and that all documentation is received and complete as agreed upon in the EIC Project Planning Document (PPD). At the completion of the SAR2, the ownership of the deliverable shall be documented and transferred where appropriate. <PARTNER INSTITUTION> shall provide all IKC-produced documentation, including travelers, test reports, and bills of materials in their completed form.

# EIC Project phases

Activities for the EIC Project described in the PPDs are planned to be executed according to four Project Phases based on design and execution maturity. The intent of such phases is to organize activities and deliverables (both Components and documents) relevant to each stage of the project. Technical reviews for production deliverables define the beginning and end of each phase. The document deliverables associated with each Phase are detailed in the Appendix of the associated PPD – Part 2.

The four Project Phases map into the DOE Critical Decision (CD) project milestones in accordance with DOE Order 413.3b. The five DOE Critical Decisions serve as major milestones within the DOE project management system. Each CD marks an authorization to increase the commitment of resources by DOE and requires successful completion of the preceding CD. The five CDs are summarized in the table below. Figure 9.1 displays the four project phases, associated technical reviews which occur within each phase and the mapping of project phases to DOE Critical Decisions.

|  |  |  |  |
| --- | --- | --- | --- |
| **Critical Decision** | **Date Undertaken (If Complete)** | **Qualifier** | **Milestone Description** |
| CD-0 | December 2019 | Approve Mission Need | There is a need or capability gap that cannot be met through other than material means. |
| CD-1 | June 2021  | Approve Alternative Selection and Cost Range | The selected alternative and approach is the optimum solution. |
| CD-3A | Planned Q2FY24 | Long Lead Procurement Approval | The Project is ready to execute the CD- 3A scope. |
| CD-3B | Planned Q1FY25 | Long Lead Procurement Approval | The Project is ready to execute the CD-3B scope. |
| CD-2 | Planned Q3FY25 | Approve Performance Baseline | Definitive scope, schedule and cost baselines have been developed. |
| CD-3 | Planned Q3FY25 | Approve Start of Construction/Execution | The project is ready for implementation. |
| CD-4 | Planned Q1FY35 | Approve Start of Operations or Project Completion | The project is ready for turnover or transition to operations, if applicable. |

**Table 1**: Anticipated CD Approval dates



**Figure 9.1:** Schematic diagram of EIC Project Phases, associated production technical reviews, and mapping to the DOE Critical Decisions project milestones.

This section describes the Project Phases and typical associated technical reviews which occur within each phase. Any deviations from this description should be detailed in the associated PPD – Part 2.

### 1) Phase 1: Conceptual Design Phase

The conceptual design phase develops an engineering design at conceptual stage, and its successful conclusion will ensure that the objectives and requirements of the design are understood and that the proposed design approach will achieve its purposes. During this project phase general requirements and general interfaces must be considered by the engineering design. Schedule and Cost estimate confidence level need to be at conceptual level as well. This phase starts with the Mission Need approval (CD-0) and the Critical Decision 1 approval marks this phase completion. This phase is officially concluded for the Electron-Ion Collider Project since June 2021 with CD-1 approval.

### 2) Phase 2: Preliminary Design Phase

The preliminary design phase develops an engineering design of sufficient maturity to establish that requirements associated with an in-kind deliverable, component, or system can be met, and a high-confidence cost estimate and schedule can be developed. The preliminary design definition and supporting requirements are detailed in the EIC TRP. The preliminary design phase culminates in the completion of the system and component Preliminary Design Reviews (PDR) and the closure of any requests for action generated by the reviews. It is often the case that the PDR is conducted during the prototyping activity, and typically applies to the production articles as well.

### 3) Phase 3: Final Design Phase

The final design phase develops an engineering design of sufficient maturity to serve as the basis for procurement, fabrication, assembly and testing of the system or component. The final design is typically supported by a complete set of assembly drawings and engineering notes, accompanied by an acceptance testing plan. The final design phase culminates in the completion of the system and component Final Design Reviews (FDR), and the closure of any requests for action generated by the reviews.

### 4) Phase 4: Procurement/Manufacturing/Acceptance Phase

The procurement/manufacturing/acceptance phase results in a completed product that conforms to the final design and meets testing and acceptance requirements at the Partner site and is ready to be transported to BNL. This phase is typically initiated by the Procurement Readiness Review and includes the validation of the transportation plan through the Transportation Readiness Review. The end of this phase comprises the two steps of SAR: the acceptance testing of the component or system at the <PARTNER INSTITUTION> site (SAR1) and acceptance testing of the component or system at BNL or another Partner if the component is destined for integration (SAR2). After a successful SAR2 the IKC deliverables are officially accepted, and their ownership can be transferred to BNL.

# Project Management Principles for In-Kind contribution SoW

The EIC Project describes the principles for technical management in distinct project management plans, which contain clearly identified sections applicable to the Partners. The following plans are specifically relevant to the EIC Partners:

* EIC Project Management Plan (PMP) [3]
* EIC Risk Management Plan (RMP) [6]
* EIC Configuration Management Plan (CMP) [4]
* EIC Quality Assurance Plan (QAP) [7]
* EIC Systems Engineering Management Plan (SEMP) [8]
* EIC Technical Review Plan (TRP) [9]
* EIC Integrated Safety Management Plan [11]

The principles described in these plans should be considered as the specifications of Project Management. They provide a standard to allow the <PARTNER INSTITUTION> to identify the Scope of Work for the management of its (in-kind contribution) project. In some cases, as stated in the corresponding sections below, the Partner is encouraged to develop these management principles into a more complete description and designate them as deliverables of the management SoW, particularly in the case of the PMP, RMP, and QAP documents.

## Project Management and Control

The EIC Project is mandated by DOE to use the Earned Value Management System (EVMS) as a tool for managing progress and performance. International Partners are not required to report EVMS or costing data to the DOE Office of Science. Instead, progress against the plan is to be measured by milestones maintained within the EIC Resource Loaded Schedule (RLS). Milestones are to be jointly developed by <PARTNER INSTITUTION> and BNL. <PARTNER INSTITUTION> is expected to be responsible for reporting progress against these milestones on a monthly basis.

Each Partner is encouraged to use a planning tool to develop its schedule and to monitor its milestones. As part of the monthly status report, the <PARTNER INSTITUTION> current schedule is to be made available to the EIC Project management.

<PARTNER INSTITUTION> should plan to provide, for each milestone in the EIC RLS, a definition that allows unambiguous evaluation of milestone completion.

## Risk Management

Risk Management is an essential component in the management of all DOE Order 413.3b projects, including the Electyron-Ion Collider. <PARTNER INSTITUTION> contribution to EIC is critical for the success of the EIC Project and therefore forms a part of EIC Risk Management process. Partners who take on a scope of work, plan to deliver their intended scope and accordingly may also take on the risk of cost overruns. Nevertheless, there are risks associated with the delivery of non-conforming items and late deliveries which need to enter into the project risk register. The EIC Risk Register plans to capture major risks associated with <PARTNER INSTITUTION> in-kind contributions. <PARTNER INSTITUTION> is expected to be invited to participate in the development of the Risk Register via EIC risk workshops.

<PARTNER INSTITUTION> is expected to utilize its own risk management tool which includes:

* Risk identification;
* Risk analysis, including potential impacts and probability of occurrence;
* Risk mitigation strategy; and
* Risk monitoring and response.

<PARTNER INSTITUTION> is to inform the EIC project management of any change of status of risks that could impact any established milestone, delivery schedule, or technical performance. The details of the risk register reporting are included in the EIC Risk Management Plan. The <PARTNER INSTITUTION>’s Risk Management Plan is a Phase 2 deliverable.

## Configuration Management

The EIC Project has a formal configuration management process described in the EIC Configuration Management Plan (CMP). The configuration management process is designed to systematically control, document, communicate and implement changes to the EIC Project baseline design, scope, performance, cost, and schedule. The requirements and process defined in the EIC CMP are applicable to *all work performed* under the scope of the EIC Project during the project lifecycle ending at CD-4, and to all proposed changes, ***including those initiated by BNL and Partner laboratories***. <PARTNER INSTITUTION> plans to follow the principles and processes outlined in the CMP. This includes the development and submission for approval of a Baseline Change Request for any anticipated change to in-kind quantities, ICD’s, schedules, functional, or technical performance requirements.

**Changes to the configuration of scope, performance, cost or schedule may need to be made by <PARTNER INSTITUTION> in response to a change initiated by BNL (or another Partner institution). Procedures for such changes are addressed in Section 12 of this document.**

## Quality Assurance and Safety

The EIC Project has a formal quality assurance process as described in the EIC Quality Assurance Plan (QAP). The EIC QAP defines, in particular, the required documentation for management of non-conformities and any associated exceptions, change control, acceptance conditions, and components approval. In addition, the EIC Project is subject to BNL policies and procedures concerning Environment, Safety, and Health (ES&H) as outlined in the BNL ES&H Database [10]. The safety management processes directly applicable to the EIC Project, including codes and standards equivalencies with Partners, are described in the EIC Integrated Safety Management Plan [11].

<PARTNER INSTITUTION> plans to prepare and implement a comprehensive QAP consistent with the requirements outlined in the EIC QAP. In addition, the <PARTNER INSTITUTION> QAP intends to outline <PARTNER INSTITUTION>’s comprehensive plans that provide assurance that all in-kind contributions can be delivered, installed, operated, and maintained on the BNL site in conformance with the BNL ES&H Database requirements and the EIC Integrated ES&H Management Plan.

<PARTNER INSTITUTION> plans to submit its QAP to the EIC QA Manager, EIC ES&H Manager, and the L2 Manager overseeing the in-kind contributions for approval. The Partner QAP is a Phase 2 deliverable.

## System Acceptance

### Acceptance of BNL Deliverables

BNL Deliverables are delivered to <PARTNER INSTITUTION> under BNL’s administrative responsibility, control and cost. A receipt verification process is planned to be deployed by <PARTNER INSTITUTION> before accepting the BNL Deliverables.

The detailed acceptance process for each BNL Deliverable is described in the PPD – Part 2 and adheres to the following principles:

* BNL is to ensure that BNL Deliverables are delivered to <PARTNER INSTITUTION> premises on a mutually acceptable schedule and within acceptable quality; and
* BNL is to manage the acceptance process for the BNL Deliverables delivered to <PARTNER INSTITUTION>. In case <PARTNER INSTITUTION> determines a non-conformity, <PARTNER INSTITUTION> is to report it to BNL at the earliest time possible.

In case of delivery of a non-conforming BNL Deliverable, BNL and <PARTNER INSTITUTION> are to jointly work on a mutually acceptable solution of resolving the non-conformance to maintain the time schedule or minimize schedule delay considering time, expertise and expense (and in accordance with Section 12).

### Acceptance of <PARTNER INSTITUTION> Deliverables

The process of acceptance for each IKC deliverable is described by the EIC System Acceptance Plan document, which defines all acceptance steps between institutions and agencies. Each IKC deliverable shall satisfy technical criteria that are identified in the System Acceptance Criteria document, which is written by BNL with the involvement of the partner institution and tailored on the specific system being delivered.

For any components procured by <PARTNER INSTITUTION> subcontract, the Factory Acceptance Tests are planned to be under <PARTNER INSTITUTION>’s responsibility. <PARTNER INSTITUTION> plans to communicate regularly with the EIC project management and engage management in any decisions.

System Acceptance Reviews are under the EIC Project management responsibility. For <PARTNER INSTITUTION> Deliverables, the System Acceptance Review is planned to occur in two phases:

* System Acceptance Review 1 (SAR1) held at <PARTNER INSTITUTION>, where the EIC Project management may approve that the components are ready to be transported to BNL. Handover for transportation is in effect after successful SAR-1.
* System Acceptance Review 2 (SAR2) held at BNL, where the EIC Project management may definitively accept the Component Deliverables after successful acceptance tests have been completed.

In case of delivery of a non-conforming <PARTNER INSTITUTION> Deliverable to EIC, BNL and <PARTNER INSTITUTION> are to jointly work on a mutually acceptable solution of resolving the non-conformance taking into account time, expertise and expense (and in accordance with Section 12).

# Transportation and Delivery

<PARTNER INSTITUTION> is responsible for the delivery of IKC as described in the PPD – Part 2. The terms of delivery and costs of transportation and insurance are to be included in the description of each IKC. BNL and <PARTNER INSTITUTION> plan to jointly develop and approve a Transportation Plan. The detailed transportation process and acceptance specifications (Acceptance Criteria) for each EIC Deliverable are described in the PPD – Part 2. U.S. import duties are covered by BNL. The shipper is expected to be responsible for transportation duties unless otherwise specified. Delays, defects, and non-conformances are to be handled according to Section 12.

# Handling Changes and non-conformances

Recognizing that the success of the EIC Project depends on each Partner adhering to the proposed plans described in the PPD documents, the Participants intend to use good faith efforts to meet the scope, schedule and performance of their contributions specified in these PPD documents.

In the event of a change to the scope, schedule, or performance of deliverables by either <PARTNER INSTITUTION> or BNL (in the design, specification or component), the Participants plan to collaboratively seek a mutually acceptable resolution, to be documented in writing, that serves the overall benefit of the Project. The following options are expected to be exercised, in order of preference:

* 1. BNL provides assistance and/or resources to the other Participant to stay on track
	2. BNL accepts adjusted schedule
	3. BNL accepts adjusted scope or performance
	4. Responsibility is transferred to another Partner willing to perform the task
	5. BNL performs the task
	6. A mutually acceptable alternative between BNL and the other Participant.

If a change is caused by BNL or another IKC Partner other than <PARTNER INSTITUTION>, and a solution cannot be facilitated in a timeframe that enables the project to stay on track, then BNL plans to consult with the other IKC Partners in order to determine a mutually acceptable adjusted scope and/or schedule.

Acceptance and title transfer of <PARTNER INSTITUTION> deliverables to BNL has been delineated in the jointly developed document titled ‘<Acceptance Plan of the in-kind contribution>’ [14]. This plan outlines the various stages of acceptance, roles and responsibilities, and several potential non-conformance scenarios, and describes the methodology for addressing non-conformances consistent with the EIC and <PARTNER INSTITUTION> QA Plans.

Once a change is mutually decided upon, the PPD is expected to be modified in accordance with Section 17 as appropriate.

These planned procedures do not apply to latent defects or to non-conformances during the R&D phase.

# Financial Matters

Cost fluctuations caused by inflation, exchange rate fluctuations, or variations in the costs of raw-materials, administrative overheads or laboratory facilities are expected to be subject to further deliberation between the Participants, who plan to use reasonable endeavors to mutually determine the responsibilities for any such cost fluctuations on a case-specific basis.

Unless otherwise specified in separate written agreements between the Participants or their governmental authorities, each Participant is expected to be responsible for all taxes, charges and fees, which may be imposed upon it by any authority in the course of its conduct of collaborative activities under this PPD.

# Transfer of Title

Upon successful completion of acceptance tests at BNL (SAR2) for each <PARTNER INSTITUTION> Deliverable, BNL expects to submit a letter to DOE reporting on the results of the acceptance tests. In accordance with all the Project Annexes referenced in Section 2.2, paragraph 2, transfer of title is intended to occur upon DOE’s submission of written confirmation to the Participant’s funding or other governmental agency that each <PARTNER INSTITUTION> deliverable has met the acceptance criteria specified in the ‘<Acceptance Plan of the in-kind contribution>’.

# Independent Project Reviews

DOE is planning to conduct typically annual Independent Project Reviews of the EIC Project over the full duration of the Project. <PARTNER INSTITUTION> plans to present technical/performance and schedule/milestone status of its in-kind contributions at or in connection with these reviews.

# Roles of Participants During Onsite Work

It is anticipated that <PARTNER INSTITUTION> personnel are to periodically visit the BNL site over the course of the EIC Project construction and commissioning phases. Such visits are for the purposes of:

* Component acceptance;
* Accelerator commissioning; and
* Discussion of status and progress on the EIC Project.

Granting of access to BNL is to be subject to the laboratory’s administrative and technical supervision and control, as well as to compliance with its applicable rules with regard to admission to and use of the premises, including safety, operating and health-physics procedures, environmental protection, access to information, cyber-security, hours of work, and conduct.  Employees, contractors and representatives of the <PARTNER INSTITUTION> concerned are expected to execute all documents required by BNL acknowledging and agreeing to comply with such applicable rules, failing which BNL may issue an order stopping all or any part of the <PARTNER INSTITUTION>’s or its contractor’s activities at its premises.

# Modifications

This PPD – Part 1 and its Appendices may be modified at any time by mutual written decision of the Participants in accordance with procedures to be specified by the BNL and EIC Directorates along with the DOE Office of Nuclear Physics Associate Director.

The Participants intend to take appropriate measures to ensure that the information contained in this PPD – Part 1 and its Appendices is kept up-to-date. To this end, the Participants intend to review the content and execute subsequent modifications at least annually in advance of RRB meetings. BNL may also request that modifications occur in advance of project reviews or other significant events.

In the event that modifications are made to this PPD – Part 1 or its Appendices, BNL intends to notify the BNL and EIC Directorates along with the DOE Office of Nuclear Physics Associate Director.

# Commencement and Discontinuation

Activities under this PPD – Part 1 may commence upon signature by authorized representatives of the Participants and continue for the duration of the EIC Project unless earlier discontinued in accordance with the following paragraph.

The Participants may discontinue cooperative activities under this PPD – Part 1 at any time by mutual written decision. If only one of the Participants wishes to discontinue its participation in the activities under this PPD – Part 1, that Participant is expected to provide at least six (6) months advance written notice to the other Participant and to the BNL and EIC Directorates along with the DOE Office of Nuclear Physics Associate Director and is expected to discuss the terms for such discontinuation.

# References

[1] DOE Order 413.3b, “Program and Project Management for the Acquisition of Capital Assets” Available: <https://www.directives.doe.gov/directives-documents/400-series/0413.3-BOrder-b>

[2] “EIC Conceptual Design Report” Available: <https://www.bnl.gov/ec/files/eic_cdr_final.pdf>

[3] “EIC Project Management Plan” Document number: EIC-ORG-PLN-026

[4] “EIC Configuration Management Plan” Document number: EIC-ORG-PLN-025

[5] “EIC Preliminary Project Execution Plan” Document number: EIC-ORG-PLN-013

[6] “EIC Risk Management Plan” Document number: EIC-PSD-PLN-003

[7] “EIC Quality Assurance Plan” Document number: EIC-QAG-PLN-002

[8] “EIC Systems Engineering Management Plan” Document number: EIC-SEG-PLN-022

[9] “EIC Technical Review Plan” Document number: EIC-SEG-PDN-009

[10] “BNL Environmental Safety and Health Database” Available: <https://intranet.bnl.gov/safety/>

[11] “EIC Integrated Safety Management Plan” Document number: EIC-ESH-PLN-007

[12] “EIC Project Governance Document” Document number: EIC-ORG-PLN-029

[13] “EIC Global Requirements Document” Document number: EIC-ORG-PLN-010

[14] “<in-kind contribution> Acceptance Plan” TBD

**Signed in duplicate.**

**FOR BROOKHAVEN NATIONAL FOR THE <Partner Institution>:**

**LABORATORY:**

Signature Signature

Name Name

Position Position

Date Date

Place Place