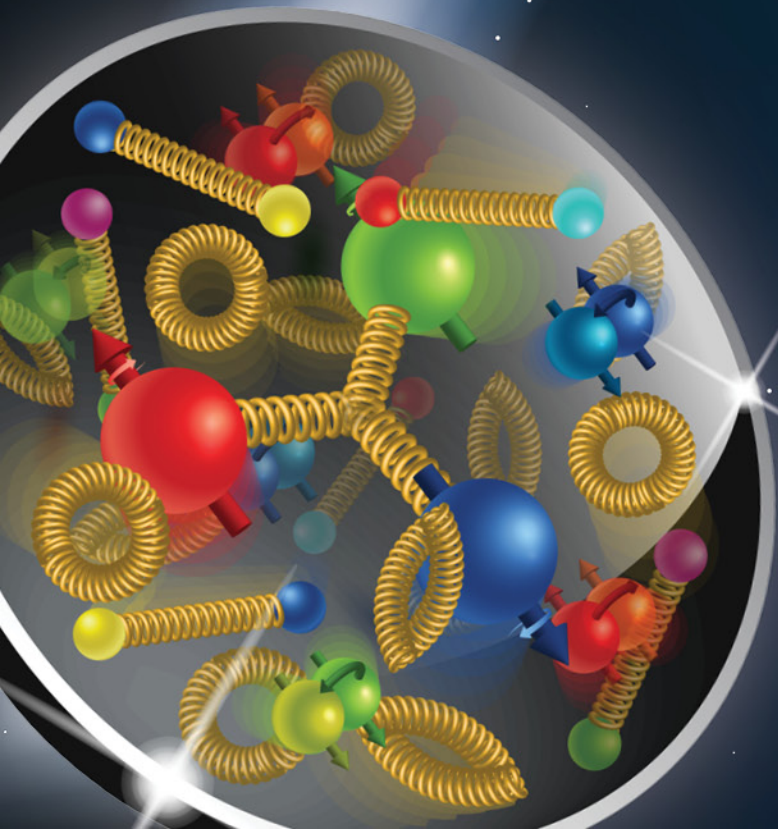




Expression of Interest Process and more Information

E.C. Aschenauer and R. Ent


Electron Ion Collider



Expression of Interest Timeline

(non-binding) Expressions of Interest (Eol) to get *guidance on detector scope*

Introduce concept and timeline for Call for Expressions of Interest March 2020
(introduce notion for Expressions of Interest for contribution to EIC detectors in plenary talks at 1st Yellow Report (remote) meeting at Temple) 

Discussion Call for Eol for **potential cooperation** to EIC Detectors 
initial discussion session at Remote EICUGM April 23 2020
final discussion at 2nd Yellow Report meeting at Pavia May 20 2020

Call for Eol for potential cooperation to EIC Detectors May 31 2020
(issue call after folding in feedback of EICUG)

Deadline Eol for potential cooperation to EIC Detectors **November 1 2020**

Status report at 4th (final) Yellow Report meeting at UCB/LBL November 19-21 2020
(Request for discussion session at 4th Yellow Report meeting on 2nd IR ideas based on YR and Accelerator Task Force status)

Evaluate Eol and inform Call for Detector Proposal(s) February 2021
(complete after assumed January 2021 Yellow Report completion, Eol can give guidance on detector scope)

Timeline beyond Expression of Interest

Assumption: CD-1 aligned with accelerator timeline

Goal: CD-2 & CD-3 also aligned!

Request Topical week-long workshop on 2nd IR early February 2021
(accelerator discussion and science discussion on 2nd IR goal and needs such that we can potentially integrate in Call for Detector Proposals)

Form EIC Collaboration(s)

Issue Call for Detector Proposals March 2021
(consistent with EICUGM assumptions of early 2021)

Deadline for Proposals September 2021
(roughly in phase with projected CD-1 date)

Detector Advisory Committee Meeting November 2021
(to guide work in TEC phase)

Selection of Detector(s) December 2021
(one or two, pending Expression of Interest response)

CD-2 September 2022

CD-3 September 2023

(CD-2 and CD-3 dates assumed for planning purposes)

Note: time to complete >80% of the full engineering & design for detector at CD-3 is tight, so we need to keep the YR efforts in motion for completion in January

Call for Expressions of Interest for Potential Cooperation to the EIC Experimental Program

Brookhaven National Laboratory (BNL) in association with Jefferson Lab (JLab) calls for an Expression of Interest (EOI) for potential cooperation to the experimental equipment as required for a successful science program at the Electron-Ion Collider (EIC). This call emphasizes all detector components to facilitate the full EIC science program including those integrated in the interaction regions.

The Electron-Ion Collider will be a powerful new facility in the United States that is constructed with the aim of studying the particles, gluons, which bind all the observable matter in the world around us. The EIC facility will collide intense beams of spin-polarized electrons with intense beams of either spin-polarized protons, deuterons, and helium-3 or unpolarized nuclei up to uranium. Detector concepts are now being developed to detect the high-energy scattered particles as well as the low-energy debris as a means to definitively understand how the matter we are all made of is bound together.

The Electron-Ion Collider User Group, which currently has more than 1000 members from over 200 laboratories and universities around the world, initiated a Yellow Report Initiative with its purpose to advance the state and detail of the documented physics studies and detector concepts to prepare for the realization of the EIC (see <http://www.eicug.org/web/content/yellow-report-initiative>). The effort aims to provide the basis for further development of concepts for experimental equipment best suited for science needs, including the possible complementarity of two detectors towards future Technical Design Reports (TDRs).

This “Call for Expressions of Interest” for cooperation to the EIC experimental program is in phase with the assumed timeline for the Yellow Report completion. The EOI will give the EIC Project guidance on current interest in participation in the EIC experimental program, including an initial understanding of the scope of the experimental equipment that might be available for the expedient start of science operations at the time of EIC project completion.

We encourage interested groups to work together within their country, their geographical region, or as a general consortium, to submit their interest for potential EIC equipment cooperation. Please differentiate if the EOI is for in-kind detector components or those integrated in the interaction regions, and detail if contributions are for full material purchases or cost reductions, are for contributed labor, or for any combination of these. Please also indicate what if any assumptions are made to receive support for the discussed cooperation from the EIC Project or the labs.

To facilitate this process, we have added a listing of “Frequently Asked Questions” below, and also provide a template for a questionnaire that may guide you to what information is useful.

An EOI is **non-binding**, and will mainly be used to guide expectations and to better understand the potential EIC experimental equipment scope.

Who issues the call:

The EIC Project (BNL together with JLab)

What is the goal:

Gauging the interest of national and international groups/consortia in cooperation to the EIC exp. equipment

Why now:

Information is needed to inform the project on the scope of the experimental equipment for the EIC program and the call for Proposals

What we need to know:

who wants to contribute
what do you want to contribute
what are your assumptions

**All set up on one webpage
let's have a look**

FAQ

2 Questionnaires to upload

- one with info to become public one with info only for EIC Project

Expression of Interest (EOI) Questionnaire

(Use this template for your document. The document can be at most 10 pages long, in this style, font and font size, but you can have appendices and do not have to include the tables in the page count. There is no prescribed format of the document, but you are asked to address the questions below. This document will be viewable by password to all who submit. You can also submit a separate document with certain information you would only like to be viewable by the EIC Project. DEADLINE FOR SUBMISSION: NOVEMBER 1.)

Please indicate the name of the contact person for this submission:

(we ask for one main contact person per submission. You can as needed provide further contacts, but there should be one primary contact)

Please indicate all institutions collectively involved in this submission of interest:

(even if institutions can submit on their own, it is highly encouraged to form groups to work together within their country, their geographical region, or as a general consortium)

Please indicate the items of interest for potential equipment cooperation:

(indicate experimental equipment components, including those integrated in the interaction regions, each separately)

Please indicate what the level of potential contributions are for each item of interest:

(e.g. indicate if contributions are for full in-kind experimental equipment components – we have provided a rough direct cost estimate for many components in an appendix, if contributions are for partial in-kind experimental equipment components, if contributions are for in-kind labor contributions, etc.).

Please indicate what, if any, assumptions you made as coming from the EIC Project or the labs for your items of interest:

(e.g., indicate if you include engineering and design activities or assume those to come from the EIC Project, if you assume certain material costs to be covered by the EIC Project, if you rely on existing capabilities at the labs, etc. Try to be as inclusive as you can be.).

Please indicate the labor contribution for the EIC experimental equipment activities:

(e.g., for each cooperation and/or institution list the number of senior staff, the number of postdocs, and the number of graduate and undergraduate students that you plan to dedicate to the EIC experimental equipment activities. Similarly, please list the number of engineers, designers and technicians included in your potential cooperation).

The time commitment of members of the <INSTITUTION NAME> group in the EIC efforts described in this EoI is anticipated to be as follows:

Institution Name	Professor	Research Professor	Staff Scientist	Postdoc	Graduate Student	Undergrad. student	Engineer	Designer	Technician	Total Sum
Institution A	0.1	0.3		0.5	0.2		0.8	0.5	1.0	
	0.1			0.5	0.2					
					0.5					4.7
Institution B	0.1			0.3	0.2	0.2				
					0.2	0.2				1.1

NOTE: FTE in the above table represents the annual fractional full time equivalent (FTE).

NOTE: for a professor, full-time equivalent research time may be limited to 25% max, for a research professor (or a sabbatical) or a staff scientist limited to 50% max, for a postdoc maybe 100%, and for a grad. student perhaps 50% (on average). For an undergraduate student research time (on average) is limited to 20% max.

(Repeat this table for each institution, or include the information for the whole group/consortium together in one table as shown above. This reflects an annual average FTE estimate. Please state below for how many years you estimate this average cooperation level to be valid.)

It is anticipated that the collaborative effort of <INSTITUTION A> to cooperate on the EIC Project is to include (at an annual basis) 0.2 full-time equivalent FTEs of a professor, 0.3 FTE of a research professor, 1.0 FTE of a postdoctoral researcher, and 0.9 FTEs of Ph.D. students. The technical collaborative effort contributed is to include up to 0.8 FTE of a (mechanical or electronics) engineer, 0.5 FTE of a designer, and 1.0 FTE of a technician. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to start at the <DESIGN/CONSTRUCTION> phase and to be for a period of <TWO/THREE/FOUR/FIVE> years.

Please indicate if there are timing constraints to your submission:

(e.g., indicate any known or anticipated timing profile assumed in your EOI. This can include anticipated time frames folding in constraints due to ongoing commitments, due to ongoing R&D and its anticipated completion date, etc.)

Please indicate any other information you feel will be helpful:

(e.g., this could be things like assembly and storage space at your institute, clean rooms and class, special skills or machine shops, or perhaps some pointers to past accomplishments – you can expand on those in an appendix. If you could make existing engineering, design or technician labor available to the EIC experimental equipment but would rely on funds coming from the EIC Project you can also list those here).

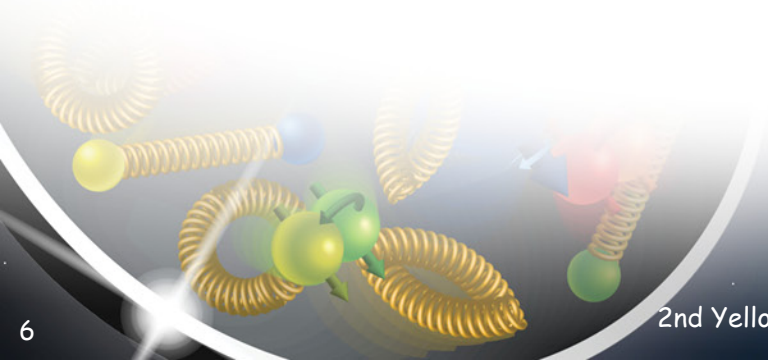
- Upload filled questionnaires from webpage
 - After uploading a confirmation email will be sent

From: BNL Web Services webservices@bnl.gov
Subject: EIC Experimental Program: EOI Questionnaire - Email Confirmation
Date: May 15, 2020 at 16:14
To: Elke-Caroline Aschenauer elke.caroline@me.com

Thank you for submitting an EIC Experimental Program: Expressions of Interest Questionnaire. Your responses have been successfully submitted and we will be in contact with you shortly.

[You can review your submitted proposal responses here:](#)

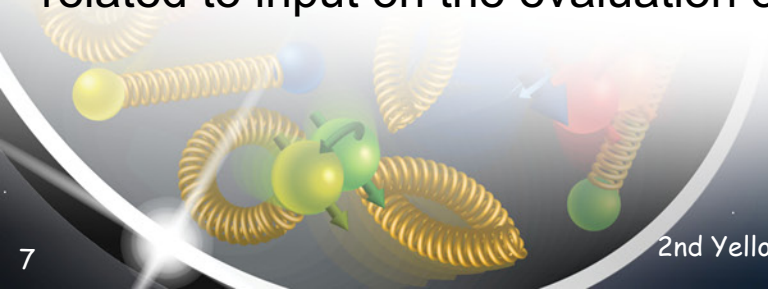
- Received input will be made public here <https://indico.bnl.gov/event/8552/>
 - Will advertise the call at
 - DNP, GHP, DPF mailing lists
 - NuPECC, ANPhA, ALAFNA
 - EIC, BNL and JLab user communities
 - Major Collaborations: ALICE, COMPASS, HERA,
 - Major Conference mailing lists: DIS, SPIN, QM
- please give suggestions to Rolf and me where else to advertise the call



Detector Advisory Committee

- International Committee being assembled now
- ~9 members, as follows
 - EIC science and general (2)
 - Global integration (1)
 - Detector integration (1)
 - Particle identification (1)
 - Electronics (1)
 - Calorimetry (1)
 - Tracking (2)
- Ex-officio members: Chair and Vice-chair of EICUGM Steering Committee
- Ex-officio members: Chair and coordinator of generic EIC detector R&D program

The first meeting is planned for early October 2020. The goal for that initial meeting is to bring the DAC up to speed and prepare them for upcoming charges, e.g., related to input on the evaluation of the Expressions of Interest.



Further detector planning

- The DOE-NP supported **EIC Project includes one detector and one Interaction Region** in the reference costing. Reference cost is the BNL estimate prepared for the DOE CD-0 Independent Cost Review (ICR).

See various talks at the 1st Yellow Report Workshop at Temple University (<https://indico.bnl.gov/event/7449/timetable/#20200319>)

Comprehensive general-purpose detector: rough costs (US project accounting) = ~\$300M

This assumed in-kind contributions (non-DOE or reused equipment) of order \$100M

Costs for one Interaction Region included in accelerator scope (US accounting) = ~\$200M

- The **EIC is capable of supporting a science program that includes two detectors and two interaction regions.**

See the Yellow Report Initiative as spearheaded by the EIC User Group (<http://www.eicug.org/web/content/yellow-report-initiative>)

The purpose of the Yellow Report Initiative is to advance the state and detail of the documented physics studies (White Paper, INT program proceedings) and detector concepts (Detector and R&D Handbook) in preparation for the realization of the EIC. The effort aims to provide the basis for further development of concepts for experimental equipment best suited for science needs, including complementarity of two detectors towards future Technical Design Reports (TDRs).

Further detector planning

The **EIC is capable of supporting a science program that includes two detectors and two interaction regions.**

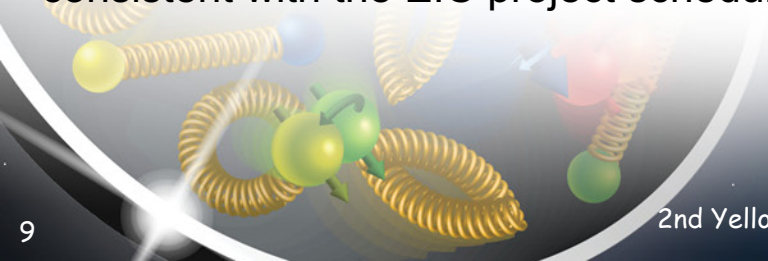
This is also the reason we asked for a separate workshop to discuss 2nd IR concepts early February 2021.

Ground rules:

- A deliverable of the EIC is the possibility for a 2nd Interaction Region (IR) and detector.
- Present EIC plans and budgets support only one IR and detector.
- All stakeholders agree that a second IR and detector within the same timeline is desirable. Routes to make this possible are being explored.
- The topic of the second detector is investigated by the US/DOE and EIC project in cooperation with the EICUG and may be handled as a separate project.

Ansatz:

Goals and schedule are driven by keeping open a possibility of a 2nd IR from day-one, and how it can be integrated into the EIC Project. If the realization of a 2nd IR would shift to a later time, a time-line to account for this would need to be developed. At this moment it seems the best strategy is to assume realization of the 2nd IR, be it significantly different or similar to the 1st IR, consistent with the EIC project schedule and to revisit the situation in a year from now.



EIC Detector Other Project Cost Activities

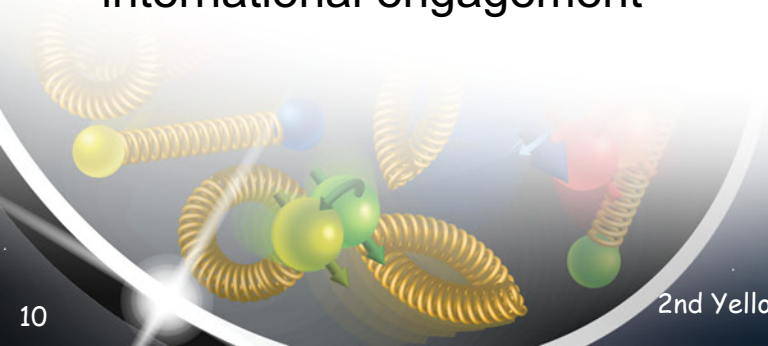
OPC Tasks for Experimental Equipment

These activities provide the basis for a “Path to CD-1” for the EIC Experimental Equipment, and more explicitly the information required for a CDR.

The activities also include some limited scope required to accompany the EIC Users Group-driven effort towards a Yellow Report and their deliberations among various detector technologies and complementary detector choices that can deliver on the science-driven technical requirements of the EIC experimental equipment.

In general, Experimental Equipment activities in FY20 will address the following:

- development of conceptual design for one detector in support of the CD-1 project package
- development of conceptual design for experimental equipment that must stay in phase with accelerator design due to the highly integrated detector and IR region
- guide the EIC User Group Yellow Report activities and support discussions on international engagement



EIC Detector Other Project Cost Activities

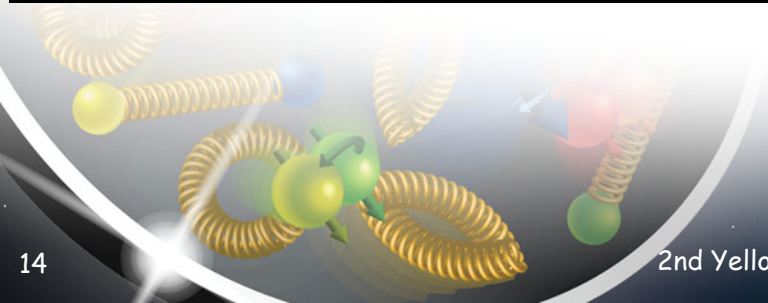
Tasks (all done as joint BNL and JLab efforts)

- Detector
 - Conceptual design of experimental solenoid
 - Engineering concept for the full detector, including integration of detector in current Interaction Region, installation and maintenance.
- Interaction Region
 - Synchrotron and hadronic background simulation, vacuum impact and mitigation, and beam pipe and vacuum pump integration design (IR, ancillary detectors)
- Electronics, Data Acquisition and Computing
 - Evaluation of ASIC, PCB and FPGA needs
 - Resource evaluation of the computing needs for a fully streaming DAQ

Task Owners

Elke Aschenauer (BNL) and Rolf Ent (JLab)

- The **EIC is capable of supporting a science program that includes two detectors and two interaction regions.**
 - The call for expression of interest is a crucial step to get guidance on the EIC detector scope. Ultimately, the EIC community will be very influential in determining the trajectory of both detectors and interaction regions.
 - The EOI call will be web-based, the information is ready for a call May 31st.
 - We request consideration of an early February 2021 “YR” workshop related to 2nd IR accelerator and science considerations.
- **CDR planning underway** – will include a plausible scenario reference EIC (general-purpose) detector.
 - CDR for experimental equipment will take advantage of pre-CDR(s), EIC Detector Handbook, interactive detector matrix, some “early-completed” YR work, some activities at the labs supported with OPC funds, etc.
 - An editorial committee for the experimental equipment has been assembled.
- **EIC Project work** – “Other Project Cost” activities for experimental equipment have started, all (5) with joint BNL and JLab staff.
- **Detector Advisory Committee** – a Detector Advisory Committee is being assembled, with as first task early October to prepare for upcoming charges, like input on evaluation of the expressions of interest.



FAQs for EoI added after 04/23 remote EICUGM

Added in FAQ based on questions:

1. Who will submit the EOI? Is it one EOI from each institution?

An EOI can be made either by individual groups or interested groups planning to work together within their country, their geographical region, or as a general consortium. An EOI helps to inform the potential national non-DOE and international engagement to the EIC Project.

2. Can institutions submit more than one EOI?

Institutions may very well consist of different groups that have more than one interest. However, any individual institution should not submit more than one EOI, and that EOI should be all-inclusive. Institutions may also join other groups and/or consortia in their Expressions of Interest, with cross-referencing to the individual institution EOI.

3. Can groups who are not part of the EIC User Group submit?

Yes, certainly they can. The call for EOI is open to anyone, regardless if they have been integrally involved in the EIC efforts to date or not. Similarly, not submitting to the EOI will not rule new interested groups out.

Frequently Asked Questions Call for Expressions of Interest (EOI)

1. Who will submit the EOI? Is it one EOI from each institution?

An EOI can be made either by individual groups or interested groups planning to work together within their country, their geographical region, or as a general consortium. An EOI helps to inform the potential national non-DOE and international engagement to the EIC Project.

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Yes, certainly they can. The call for EOI is open to anyone, regardless if they have been integrally involved in the EIC efforts to date or not. Similarly, not submitting to the EOI will not rule new interested groups out.

4. To whom do we submit the EOI?

The EIC Project. We will collect all submitted EOIs at a web page **TBD**.

5. What exactly will this expression of interest be used for?

To inform the EIC Project about what detector scope can be built, e.g., if one or two detectors would be included, one or two interaction regions, what ancillary equipment to assume, etc. It may be used to inform with which countries agreements in any kind of form are desired. It may also be useful for further discussions between DOE and NSF.

6. What exactly is the topic of the call? Physics interest or interest in building scientific equipment, e.g. part of a detector?

This call does not include physics interest and is solely aimed at the experimental program. It can include interest in taking full responsibility for a subdetector or other equipment towards the EIC experimental program such as those integrated in the interaction region, it can include intent to provide funds towards such a subdetector or other equipment, or it can give an idea what labor (FTEs and type (students, postdocs, engineering, ...)) towards the experimental equipment may be contributed.

7. Are Data Acquisition, Online and Offline Software tasks included?

Data acquisition and software tasks should be included in the response to the call, these are considered part of the experimental program. Often, only those tasks needed to confirm the Project's deliverables are part of a formal DOE Project, whereas the more general software development towards higher-level physics analysis is seen as scientific research task. In either case it will help understanding towards potential cooperation.

8. Can groups or institutions that have their regular support from DOE-NP submit?

Absolutely. Also for those groups and institutions the EOI will be used to gauge potential engagement towards the EIC experimental program, be it through interest in cooperating in or building scientific equipment, potential labor cooperation, etc.

9. Should Brookhaven National Lab and/or Jefferson Lab submit?

Both Brookhaven National Lab and Jefferson Lab have a vested interest in the scientific outcome of the EIC and plan to cooperate under a partnership agreement. As such, BNL in association with JLab first and foremost will act as host for the EIC Project, and both actively work together towards the timely and successful completion of the EIC Project, its Experimental Equipment, and the implementation of the EIC experimental program. As such, individual EOIs of BNL and JLab should instead detail the resources and expertise available to the EIC project. However, it is expected that BNL and/or JLab may join other institutions and/or consortia in their Expressions of Interest.

10. What is exactly meant with assumptions from the DOE-NP Project or the labs?

When you submit your expression of interest there likely will be need for laboratory or EIC Project support. For example, for in-kind experimental equipment cooperation you may need storage space at the lab(s), or access to test equipment. Or you or your group cannot provide engineering and design activities and rely on those from the EIC Project. Or you need those only for the integration activities. Or your expression of interest relies on certain material costs to be covered by the EIC Project, etc.

11. Is there a financial/funding context to this?

No, in the sense that the submission to this Call for Expression of Interest is non-binding. Yes, in the sense that it will be used to guide experimental equipment scope of the EIC.

12. What will the information submitted be used for?

The information will be used to gauge potential engagement in the EIC experimental program. This includes DOE-NP EIC Project, DOE non-Project, national non-DOE-NP, and international engagement to the EIC equipment, be it experimental equipment or cooperation in the Interaction Regions. Such information can be used to evaluate the scope of the EIC experimental equipment potentially available and the possibility of two fully instrumented interaction regions and their detectors.

13. Where does this step lie on the path to build collaborations that propose detectors?

The call for detector proposals will come after an evaluation of the EOI submissions. The evaluation will guide the call for detector proposals.

Further planning for Conceptual Design Report

Recall at 1st Yellow Report meeting at Temple U:

- At CD-1 we need a plausible scenario reference design for any general-purpose detector (= one full detector to do the NSAC/NAS Report science)

CDR planning for experimental equipment ongoing

- Plan to assemble editorial board (mix of BNL staff, JLab staff, and users – taking strong advantage of ongoing Yellow Report activities)
- Section 2 Science and Requirements
 - 2.1 EIC Experimental Equipment Introduction
(EIC Physics, Accelerator Requirements, IR and Detector Requirements)
 - 2.2 EIC Context and History
 - 2.3 The Science Goals of the EIC and Machine Parameters
 - 2.4 Summary of Machine Design Parameters for the EIC Physics
 - 2.5 Scientific Requirements for the Detectors and IRs
 - 2.6 Scientific Requirements for the Detectors
 - 2.7 Scientific Requirements for the Interaction Regions

Much of section 2.2-2.7 is similar to the pre-CDR document submitted by BNL for the DOE Independent Cost Review, whereas section 2.1 can be adapted from the JLab version

- Section 3 (or later) The EIC Experimental Equipment – see next slide

Further planning for Conceptual Design Report

CDR planning for experimental equipment ongoing

- Plan to assemble editorial board (mix of BNL staff, JLab staff, and users – taking strong advantage of ongoing Yellow Report activities)
- Section 3 (or later) The EIC Experimental Equipment
 - 3.1 Experimental Equipment Requirement Summary
 - 3.2 Realization of the Experimental Equipment
in the National and International Context
 - 3.3 EIC Kinematics
 - 3.4 Physics Requirements for an EIC Detector
(Rates and Multiplicities, Detector Requirements, IR Integration and Backgrounds)
 - 3.5 Reference EIC Detector
(Central Magnet Considerations, Detector Realization, A Model Detector, Ancillary Detectors)
 - 3.6 Installation and Maintenance
(Infrastructure and Integration, Installation, Maintenance)

Section 3.1 and 3.2 is an intro/recap. Much of section 3.3 and 3.4 is similar to what we have in the “EIC detector requirements and R&D handbook”, folding in also the interactive detector map/matrix as developed for the YR efforts. Section 3.5 and 3.6 also benefit from ongoing YR efforts. Some sections require input from Experimental Equipment activities started by the labs with OPC funds (e.g., the central magnet considerations, the IR integration, installation and maintenance modes).