Detector Advisory Committee Report from Meeting October 19-21, 2022

December 8, 2022

Participating Members: *E. Auffray, P. Krizan, E. Kinney, E. Rondio, H. Schellman, B. Vachon, A. White, C. Yang, G. Young*

Summary

The Detector Advisory Committee met via zoom over the three-day period of October 19-21, 2022. After a presentation summarizing the progress since the Detector Proposal Advisory Panel in early 2022, the committee heard presentations of ongoing and future EIC project detector R&D projects. Comments are provided on the status presentations of the project and ePIC collaboration first, then review of each of the eRD projects. Finally, some overall comments and recommendations from the DAC are provided.

1. Project Status

The DAC is impressed of the strong progress made since the February during the formation of the ePIC collaboration and the development of a first detector at IP6. Technical review of the ECCE detector has revealed that a higher magnetic field solenoid than was proposed will be required to meet the performance goals described in the EIC Yellow Report, and the design and costing of the new magnet is underway. The project has supplied significant management, fiscal and engineering resources to support this progress. We understand that the initially unforeseen availability of funding has provided an important boost to this progress. It is clear that special attention is being given to long lead time items, and the project appears on track to meet the timing of the next DOE project milestones CD2/3a.

2. Status of ePIC Detector and Collaboration

The DAC applauds the rapid formation of the new ePIC collaboration from the members of the ATHENA and CORE collaborations and the ECCE proto-collaboration. Although the complete formation of the collaboration is still in process, they have clearly formed a strong working group to carry on the final design of the detector including many technological design choices. The excellent presentation highlighted not only the progress, but also the critical path decisions upon which the collaboration is now focused. Enormous progress has been made in developing a coherent design for a detector to carry out the EIC research goals, with well-defined open critical questions. Additional impressive achievements are the critical creation of common simulation environment with the “October Simulation Campaign,” and important progress in integration of the readout software/framework at this early stage. As the project progresses on this tight timeline we recommend close monitoring of manpower and commitment to EIC as groups are also involved in outside projects both in the US and at international laboratories. The collaboration appears working strongly to keep on-track with the project timelines.

3. R&D Proposal Review

3.1 eRD101 mRICH Project

3.1.1 Findings

This recently initiated project is to further develop a Modular RICH detector for use in particle identification in the electron endcap of the EIC detector. A Fresnel lens focusses čerenkov light from aerogel on to a focal plane instrumented with photosensors. A prototype detector was tested in a beam in the Hall D of Jefferson Lab in October 2021. Preliminary results of the test were presented. The data show mRICH performance with pattern matching as function of position on aperture. Future work was planned to optimize focal plane position and aerogel block size using a new prototype. Additional work was planned to incorporate the observed performance into the global EIC detector simulation package. There is concurrent work planned (described in eRD102, 109 and 110) to develop the photosensors and readout; the eRD101 group is expecting to coordinate with these other efforts.

3.1.2 Comments

The committee was happy that a more realistic beam test has been performed, and hopes the data is further analyzed soon, especially with respect to determining the single photon angular resolution. Further, in order to evaluate the effect of the observed performance on the EIC physics performance, simulations with realistic particle fluxes need to be carried out very quickly. It was not clear that an additional prototype/beam test cycle was needed or could be carried out without delaying the project. In addition, the question of photosensor remains open, which impacts engineering and support requirements. There needs to be additional person power brought to this project to increase the speed of R&D in order to be compatible with the project deadline.

3.1.3 Recommendations

1. Efforts of the group should be focused on understanding data in hand and using it to develop realistic simulations to understand the physics performance
2. Additional effort is needed by the groups in order to accelerate the rate of progress if they are to meet timelines for critical decisions.

3.2 eRD102 dRICH Project

3.2.1 Findings

This recently initiated project is to further develop a Dual-radiator RICH detector to provide excellent particle identification over a broad momentum range in the ion side of the EIC detector. Photons from fluorocarbon gas and aerogel radiators are focused by mirrors onto photosensors. In the past year there have been two successful in-beam tests of a baseline prototype at Jefferson Lab and CERN; preliminary results have already been presented at national and international conference. Data from additional recent (Sept/Oct 2022) in-beam tests at CERN using an upgraded prototype are under analysis. Plans for the future focus on the critical elements of further development of the prototype and engineering of a mature detector design, location and development of supplier(s) of sufficiently high-quality aerogel at the desired index of refraction and low-density high-quality spherical mirrors, and the development of photosensor and readout electronics with the required capabilities and means to recover from radiation damage. The latter will be coordinated with eRD109 and 110 efforts. Performance data is being used to continually develop an existing dRICH simulation model which is already now incorporated in the ePIC simulation framework. This allows PID studies in conjunction with other detector systems to understand overall EIC detector performance.

3.2.2 Comments

The committee was impressed with the aggressive program of prototype development with in-beam testing, keeping the project in step with overall EIC project timelines. This R&D program is broad, with many efforts, hence it is critical to stay focused on critical design choices. In addition to finding the necessary aerogel production facilities, the study of a pressurized gas vessel remains of importance due to the continually increasing difficulty of obtaining and using fluorocarbon gases. Good progress appears to be in hand with mirror production. As with many detectors, the choice of photosensor remains a critical open question.

3.2.3 Recommendations

1. We recommend continued active investigation of aerogel from different vendors with adequate characterization of optical quality.
2. We recommend continued study of mirror vendors to reduce the risk from a single vendor/technology.
3. The group should revisit with new simulation tools and the ePIC design the effect of the expected neutron fluence on the photon detector side, with regard to possible SiPM use.

3.3 eRD103 hpDIRC

3.3.1 Findings

This recently initiated project is to further develop a high performance DIRC detector to provide particle identification over a broad momentum range in the barrel region of the EIC detector. The present plan is to use the DIRC bars from the BaBar detector, most of which are still stored at SLAC. In the past year the group has set up a cosmic ray test stand at Stonybrook University to study prototype DIRC geometries, photosensors and readout electronics. Further developments of the test stand are planned. Concurrently a test facility to evaluate the disassembled BaBAR DIRC bars has been developed at Jefferson Lab and will be used in upcoming year as soon as the bars are shipped to Virginia. As with many detectors, the choice of photosensor and readout remains a critical open question as well as the development of a streaming readout system for this detector.

3.3.2 Comments

The committee was impressed with the development of both test facilities as well as the excellent collaboration with the PANDA DIRC effort. Further, it was clear that the group is staying in close contact with the original BaBar DIRC developers and profiting from their experience. The good performance of a BaBar DIRC bar in a Jefferson Lab experiment is hopeful, however, this was not a disassembled bar. At present the project appears on track to meet EIC project deadlines, assuming no major problems are found with the BaBar DIRC bars. Again, sensor and readout electronics are in coordination with eRD109 and 110. Some experience in the readout from this type of detector has been gained by researchers at U. Hawaii and Nalu Scientific.

3.3.3 Recommendations

1. It is recommended to start the process of opening/studying DIRC bars as soon as possible in order to meet the project timeline, especially in case of significant problems.
2. We also recommend a strong effort to develop streaming readout in collaboration with U.Hawaii and Nalu Scientific researchers.

3.4 eRD104 Silicon Services Reduction

3.4.1 Findings

This recently initiated project is to study how to reduce the impact of required power and readout services to the silicon tracker system of the EIC. While the focus of the R&D on the silicon tracker, the results may be of use to other systems. As the design of the silicon tracker is evolving in conjunction with the development of the ITS3 MAPS sensors, this R&D has not been directed to a specific design. Two main powering options are being considered, one using DC-DC converters and the other using a scheme of serial powering. Groups with experience in the ATLAS and CMS silicon tracker are developing a protype board to test the serial powering option. An additional effort to us on-chip DC-DC converters is the subject of eRD113. The readout development has focused on characterization of the readout requirements for the foreseen MAPS architecture with based on a radiation tolerant FPGA components in a MUX board allowing the readout of aggregated data over high speed optical links from the tracker as opposed to Twinax cabling from each sensor block. Sensor control is also foreseen in this system.

3.4.2 Comments

This particular project is part of a large broad effort of the EIC Silicon consortium, and eRD104 appears to have good access to the necessary expertise and manpower for carrying out the proposed studies and design work. The timelines appear on track with the EIC project however, the continued development is closely tied to the CERN program, especially the development of the actual tracker design based on ITS3 sensors.

3.4.3 Recommendations

1. The group should continue to aggressively design, build and test prototypes in time for critical decisions, with close attention to the evolving tracker design and requirements.

3.5 eRD105 – SciGlass R&D

3.5.1 Findings

This recently initiated project is continuing to develop and characterize SciGlass to provide an alternative material to $PbWO_4$ crystals for EM calorimetry. If the material characteristics can be made similar or better than $PbWO_4$, they would provide considerable savings without loss of performance. Indeed, they could have significantly better performance in terms of temperature sensitivity. The development is a collaboration of the group and the Scintilex company. In the past year, progress has been made in the production of 40 cm long blocks needed for sufficient radiation length as well as the actual molding process. Longitudinal light transmission and radiation tolerance have been characterized and successful in-beam tests were performed at Jefferson Lab Hall D using small calorimeters of both 20 cm and later 40 cm length. Future work will focus on further more detailed characterization of the material as well as development of the photosensors and readout; presently this detector is foreseen to be read out with SiPMs. Testing will be coordinated with ERD109 and 110. The project appears to be progressing in a timely manner.

3.5.2 Comments

The committee applauds the successful manufacture and testing of the 40 cm blocks as that was a critical development. A number of additional studies were thought to be important, especially the details of uniformity of density, index of refraction and scintillation along, and across the block, for example transverse transmission as a function of distance along the block. Further work to characterize the transverse position resolution with both simulation and measurement comparisons is needed and the concurrent optimization of block size relative to the Moliere radius. While initial studies indicate the new material is radiation hard, further extended studies to verify this would help prevent any later surprises. Another issue to be investigated is the understanding of large scale production times for both uniformly shaped blocks as well as those with projective geometry shapes. Whether the large scale production would take place at Scintilex or at an outside foundry was still an open question; we expect that the learning curve at an outside foundry might be significantly longer than expected.

3.5.3 Recommendations

1. It is recommended to continue to aggressively characterize the SciGlass as a material especially with regards to uniformity.
2. We recommend study of transverse position resolution (by simulation and measurement) as well as the optimization of block size.
3. We recommend a thorough evaluation of possible large scale production issues that could significantly delay manufacture, both at Scintilex and/or an external foundry.

3.6 eRD106 Forward pECal R&D

3.6.1 Findings

This new proposal plans to develop a 64-channel prototype of the forward pECAL (EM calorimeter in the ion direction). The collaboration has chosen a W-powder/Scintillating fiber for the calorimeter technology and the present study seeks to optimize the uniformity and efficiency of light collection using a compact SiPM readout by focusing on the best sensor/fiber connection. Readout studies will be coordinated with eRD109. The prototype will be tested at Fermilab.

3.6.2 Comments

The proposed activities are straight forward, however the committee suggests that other, possibly simpler, readout alternatives are investigated.

3.6.3 Recommendations

1. In addition to carrying out the proposed design studies, we recommend investigation of other simple sensor/fiber readout alternatives.

3.7 eRD107 – LFHCAL Hadron Calorimeter

3.7.1 Findings

This new proposal plans to study aspects of the production of the hadron calorimeter located on the ion side of the EIC detector (LFHCAL). The basic design is of alternating steel and plastic scintillation tiles with wavelength shifting (WLS) fibers to carry signal light to photosensors. The WLS fibers are embedded in the scintillation tiles in small grooves. Machining the grooves into each tile adds significantly to the time and expense to produce each tile. The group will investigate the use of injection molds to produce tiles with the grooves. A prototype tower module will be constructed and tested to characterize performance with both machined and injection molded tiles as well as to test the prototype sensor board being developed as part of eRD109. The group plans to automate the WLS fiber/scintillation tile assembly using multiaxial robot arms, and will develop this procedure. Concurrently, simulations will be used to optimize the performance of the calorimeter in the EIC detector.

3.7.2 Comments

The LFHCAL design is relatively advanced and the R&D proposed appeared focused on production and engineering issues, rather than performance. For example, the development of automated assembly is probably needed, but was not considered an R&D effort. We do note the good collaboration with the experienced CALICE group. Clearly tests are needed to understand the production and quality of the injection molded tiles as well as the prototype performance in beam. It is also very important to incorporate the observed performance parameters in the global ePIC simulation in order to understand the impact on the physics performance. The tile production issues are especially important given the tight project timeline for CD2, when accurate cost estimates are needed.

3.7.3 Recommendations

1. We recommend the production and testing of the injection molded tiles
2. The group is recommended to proceed with the prototype assembly and in-beam testing to characterize performance.
3. Results of these tests should be incorporated quickly into the simulation framework of the ePIC detector in order to study their impact on physics performance, including optimization of the LFHCAL design itself.

3.8 eRD108 MPGD R&D

3.8.1 Findings

This already initiated project continues to develop the μRWELL technology as an alternative to the MicroMegas (MM) technology in the barrel tracker around the central region. As of Sept 2022, ePIC plans to use the MM technology for the barrel tracker. Additional efforts are underway to explore operation of a μRWELL tracking layer in μTPC mode as well as the development of a hybrid thin-gap GEM-μRWELL tracking layer. These studies of new detector technologies are motivated by possible additional tracking needs in the EIC detector. A readout system based on the VMM3 ASIC is being developed for the μRWELL prototypes. The MM effort is focused first on construction of a small-scale prototype tracking tile, followed by development of a full size prototype tracking tile.

3.8.2 Comments

Good progress has been made on the design and construction of a cylindrical μRWELL prototype tracker including a 2D readout pattern along with the VMM3-SRS readout. It is not clear that the VMM3-SRS readout can be developed as a fallback for a streaming readout system; if not, more coordination with the eRD109 effort may be appropriate. Progress on the MM prototype concentrated on development of the readout Kapton foils and their 2D readout pattern. While the μTPC mode, thin gap GEM-μRWELL studies are of interest and may find application within the EIC detector, it was felt that these efforts fall more under a generic R&D program. The MM R&D program will require significant effort in order to achieve its goals in the next year, especially the critical construction and testing of large barrel tracking panels, which may suffer from issues not seen in smaller prototypes. Present production plans rely on CERN facilities and not (at least initially) on a proposed new facility at Jefferson Lab; production capability in addition to that of CERN would reduce project risk.

3.8.3 Recommendations

1. Given the short timelines and evolving tracking needs, high priority should be given to the MM prototyping and development efforts.

3.9 Electronics and ASICs R&D

3.9.1 Findings

This new proposal consists of 5 distinct efforts to develop readout electronics for the different components of the EIC detector. All must support the planned streaming readout. Sub-projects A and B are developing SiPM readout electronics using existing components (COTS or HGCROCv3) for use in the calorimeters. Sub-project C is developing a readout solution for SiPMs in the dRICH with the existing ALCOR v2 ASIC expecting to help develop a final ALCOR v3 design. Sub-project D is focused on the readout of AC-LGADs, with several different solutions under study: 1) the development of the EICROC ASIC, 2) development of the FCFD ASIC and 3) investigation and characterization of 3rd party ASIC solutions. Since this sub-project involves substantial ASIC development there is also need for front-end board and services development. Finally sub-project E is the development of a readout solution for the MPGDs based on previous ASICs. The SALSA ASIC will need several stages of development to be finalized.

3.9.2 Comments

This project comprises an active program for many detector/sensor systems, often in coordination with detector R&D groups. The somewhat overlapping efforts should mitigate risk and lead to synergy in R&D. It is important for all these efforts to develop and test full readout systems (e.g. from detector to electronics hut cable lengths). It is essential that all of these sub-groups are in good communication with each other so that experience is quickly dessiminated. In the efforts involving new ASIC development careful attention to ASIC development time cycles with vendors will be needed to keep to project timeline; present estimates seem possibly too optimistic. Historically development time has been significantly under-estimated. Already the present R&D is foreseen to extend right up to CD2 and additional time will be needed to develop final design for fabrication and assembly, with some electronics not installed until 2031.

3.9.3 Recommendation

1. We recommend close monitoring of progress in ASIC development and testing to meet project timelines.

3.10 Photosensors for EIC Detectors

3.10.1 Findings

This recently initiated project is performing an in-depth evaluation of commercially available photo-sensors for use in the EIC, primarily LAPPDs, HRPPDs and SiPMs. The study of MCP PMTs was deferred. These sensors were investigated primarily for their use in Čerenkov light detectors. The focus of the LAPPD/HRPPD effort is to characterize the timing and spatial resolution and the performance in high magnetic field. Successful LAPPD studies have been performed in a high field facility at ANL and two in-beam tests at FNAL and CERN. A direct pixel readout design for an HRPPD tile has been developed, which is planned to be completed as a prototype for testing in high field and in-beam along with further studies of the LAPPDs. A focus of the timing studies is the determination of whether the timing precision of these sensors is sufficient for TOF measurements. The focus of the SiPM effort is to understand the effects of radiation damage from measured doses on the SiPM performance and to what the extent high temperature annealing can mitigate these effects, especially and over many cycles of dosing/annealing. Using a test stand at INFN preliminary results comparing in-situ vs over annealing have been obtained. In conjunction with eRD 102 (dRICH) and 109 (ALCOR) groups they recently performed in-beam tests at CERN.

3.10.2 Comments

Photosensors are a critical component to overall EPIC realization, especially with respect to PID detectors, and is stongly coupled to the ASIC development program in eRD109. Good progress has been made to characterize the commercially available LAPPD in high field and in test beams. The proposed program addresses important open questions and appears to be on track with project timelines. It is important to investigate if alternate LAPPD vendor exist to mitigate risk. The annealing process seems promising for SiPMs; long time experience from STAR calorimeter annealing is also hopeful, however, single photon resolution requirements may be more stringent for RICH photon detection. It is also important to use conservative estimates of the expected fluences (10^{10}) and to explore what the impact of cooling/annealing/readout electronic infrastructure will have on global performance.

3.10.3 Recommendation

1. We recommend continue aggressive study of both the LAPPD/HRPPD and SiPM performance in realistic operation environments.

3.11 Silicon Tracker

3.11.1 Findings

This recently initiated project is concentrating on the actual development and optimization of the design of the disks and barrels of the EIC silicon tracker formed from MAPS. Since the geometry is different from the ALICE ITS3, this requires some separate R&D effort, though with experience gained from the CERN R&D. The current ePIC design has 5 barrel layers, 4 of which are curved stitched sensors. In addition there are 5 disk layers in on each side of the collision point, which along with the outer barrel, use a staved design. The design is still evolving especially in consideration of the need to operate at higher magnetic field. Consideration of the mechanics, cooling and services structures is important to the design and performance; simulations are using to study the effect of design and stitching options both in terms of material budget and tracking performance. The feasibility of air cooling has also been tested and a CAD model developed to advance the infrastructure development.

3.11.2 Comments

Along eRD104 and eRD113 this is large effort with progress on many fronts, including tools to study impact of design choices on physics capabilities. We note the strong in-kind contributions by many institutes of consortium. Progress on the design development has been slowed by some delay at CERN but still appears on track for CD2. This R&D project is strongly tied to ITS3/ALICE R&D; ties to the foundry seem intact at present. We note also that the ITS2 appears to be close to no longer being a fallback solution since the development effort is commensurate with that of ITS3.

3.11.3 Recommendation

1. The project is recommended to continue its aggressive program to develop the tracker design in order to make the necessary progress by the time of CD2.

3.12 AC-LGAD R&D

3.12.1 Findings

This recently initiated project develops the AC-LGAD technology which is planned to be used in both the main detector for TOF as well as in the far forward and backward instrumentation of the beam line near the main detector. This is a large effort on many fronts with focus not only on the fabrication of large area AC-LGADs, but also the concurrent development of the readout electronics including ASICs. A high level preliminary design for AC-LGAD detectors has also been developed for the EIC. First productions of AC-LGADs with varying doping, pitch and gap size have been successfully operated and readout in the test beam at Fermilab. It is planned to now attempt production of thinner AC-LGADs for TOF applications as well as to continue development, characterization and simulation sensor/ASIC integrated design with front-end electronics in a realistic light weight mechanical support structure.

3.12.2 Comments

The project has made significant progress in a relatively short time, especially as the R&D has been not only on sensor development but also readout electronics and in-beam testing. So far the results look quite promising and on track with project timelines. It is clearly important to continue to study the options of sensor production, both at BNL and at commercial vendors, to mitigate risk. Given the time constraints, it is important to understand the needs of ePIC to optimize performance in time vs spatial resolution, especially in the forward and central regions (which may not have the same requirements). The impact of the planned cooling/readout infrastructure should also be studied as the detector designs become more developed.

3.12.3 Recommendations

1. We recommend continued study of sensor production options and vendors.
2. We recommend continued study of ePIC performance based on sensor characterization and the presence of realistic cooling/readout infrastructure.

3.13 Silicon MAPS R&D

3.13.1 Findings

This new proposal, as part of the other silicon tracker R&D efforts, eRD104 and 111, is directed at the actual 65 nm MAPS development that is needed in the EIC silicon tracker. Prior to this project, consortium members have already been contributing to the ITS3 MAPS development with contributions to the first production board MLR1 and then more to the first engineering production ER1. At early stages this project was expected to be in sync with the same R&D efforts to develop the ALICE/ITS3, however now this R&D must branch off in order to obtain MAPS with the characteristics and performance needed at the EIC. Critical design toolkits have been shared with the EIC consortium allowing independent design, however the “legal” status with regard to CERN and ALICE has been uncertain. This uncertainty has made it difficult to define the independent EIC development activities relative to those of ALICE. In the coming year plans are to develop EIC specific circuit blocks but also contribute to the ITS3 sensor design, understand implications of a change in the stitching plans for large area sensors, obtain more MLR1 boards for further study as well as become more involved in the ER1 test setup development.

3.13.2 Comments

It is appreciated that much of this effort has already been carried out as in-kind contribution to the EIC R&D. It is clear that the R&D and collaboration ties with ALICE and the ITS3 project need to be continued and strengthened. Special attention will need to be paid to maintaining the EIC development schedule within the context of the ITS3 development without disturbing the balance of the collaborative efforts. This likely requires careful planning and sufficient manpower and fiscal resources. For example, it will be important to characterize not only the performance but also the reliability and stability of the 65 nm MAPS in the EIC environment, which may lead to different requirements from those of ALICE.

3.13.3 Recommendations

1. As soon as possible the formal arrangements to allow a closer working relationship at CERN and ALICE need to be finalized.
2. It is recommended to continue the aggressive development of the EIC 65nm MAPS with strong involvement in the test production runs and sensor testing activities at ALICE/ITS3.

4. General EIC and ePIC Comments and Recommendations

Again, congratulations to all on the enormous progress, in so many areas, in such a short time! We applaud the use of topical workshops to ensure good communication between overlapping development efforts and to build community. We strongly recommend their continued scheduling. We noted that many projects are at the stage of planning tests with particle beams; overall coordination might be very useful especially where common test infrastructure could reduce the duplication of effort and also to reduce test beam scheduling complications. Under the new ECFA R&D Roadmap the RDxx collaborations (and others) are being reorganized into DRDx collaborations. For instance, RD51 for MPGDs is becoming part of DRD1 and is being merged with other gas detectors (drift chambers, TPCs,...). These transitions will take place during 2023 and the new DRDs will start 1/24. There is concern about this distracting from R&D progress while the transitions occur and any delay that this might cause to EIC/ePIC (which is already on an aggressive schedule and is relying on connections to CERN/European R&D.) We also urge the collaboration to work to expand the manpower resources as soon as possible in order to keep progress on track, as there is little time between the periods of R&D and final design activities and the EIC detector production, installation and commissioning activities. We know you are aware of the tight constraints of the project timeline!

Overall, we recommend more direction of effort towards final detector development for CD2/3a (as is already happening in some of the eRD groups). It is important to move from R&D activities to detector specific designs and at next review we feel it will be important to hear how R&D is being or was used in the development of final designs, especially in the cases of critical design choices.

Appendix A – Charge to EIC Detector Advisory Committee **– 5th Meeting October 19-21, 2022**

The EIC Detector Advisory Committee (DAC) provides advice to the EIC project managed by BNL in partnership with Thomas Jefferson National Accelerator Facility (TJNAF) on the experimental equipment and the scientific collaboration. This includes advice on the suitability of the experimental equipment for the EIC science, on cost, schedule and technical risk of detector components and design choices, and relative importance of technical tasks, on evaluation of complementary EIC detector technologies and the complete detector proposals, on collaboration formation, on detector integration, detector-interaction region integration, and detector commissioning, and on EIC-related detector R&D.

The roadmap to the next phase(s) of EIC remains rapid. Critical Decision-One (CD-1) was awarded on June 29 2021 and allowed for release of Project Engineering and Design (PED) funds. This initiated the next phases of design of accelerator and detector. With the recent EIC funding from the Inflation Reduction Act, the EIC project aims for CD-2/3A (baseline approval and start of long-lead procurements) early 2024 and CD-3 (start of construction) one year later.

The March 2021 DAC meeting concentrated on the transition from the successful 2011-2021 EIC-related generic detector R&D program (https://wiki.bnl.gov/conferences/index.php/EIC_R%25D) to the Project detector R&D program, and on giving advice for opportunities and priorities for a generic EIC detector R&D program. Since that time,

- The EIC Project has started the project detector R&D late Summer 2022.
- Jefferson Lab, in association with Brookhaven National Lab and the DOE Office of Nuclear Physics, has restarted a generic detector R&D program to address the scientific requirements for measurements at the future Electron Ion Collider. This program is overseen by a dedicated advisory panel.

For the EIC project detector R&D, there were some that we could not initiate yet, for various reasons. These include the forward electromagnetic and hadronic calorimetry that was on hold to allow a change of detector technology, the Silicon MAPS/ITS3 sensors that moved in the proposal process from generic to EIC project detector R&D, and the various ASICs-related R&D that were collected for consideration at a recent August 29 electronics/DAQ subsystem status review. We intend to start contracts for these pending your upcoming DAC meeting and deliberations.

In late 2021 and early 2022, the DAC provided advice to an ad-hoc Detector Proposal Advisory Panel for the EIC detector proposal and selection process. See https://www.bnl.gov/eic/cfc.php and https://www.bnl.gov/dpapanelmeeting/. This process concluded that from the three submitted proposals ATHENA and ECCE satisfied the requirements, and that many collaborators were involved in multiple proposals. It was strongly encouraged for the three proto-collaborations to move forward together based on ECCE as the reference design for the project detector. Since that time the ATHENA and ECCE collaborations have merged in the new EPIC detector collaboration.

The 5th DAC meeting will span October 19-21 and will be used to inform the committee on the progress and status of the EIC project, on the progress and status of the EPIC detector since the DPAP process, but will mainly concentrate on the status of the various EIC project detector R&D projects that have started and review the plans and requests for the upcoming year.

For the October 2022 DAC meeting we welcome your guidance and advice on the following topics:

- The status and progress of the EIC Project.
- The status and progress of the EPIC detector and collaboration following the consolidation and optimization process after the DPAP.
- The status, progress and plans for the EIC project detector R&D that has been initiated recently (eRD101-105, eRD108, eRD110-112).
- The plans for the EIC project detector R&D that have not been started yet, for various reasons (eRD106-107, eRD109, and the new eRD113)
- Further planning for the outyears of the EIC Project detector R&D as documented in the "Assessment of R&D Needs for an EIC Detector" (EIC Detector R&D) document.
- What do you see as priorities for the proposed EIC-related Project detector R&D?

References:
DAC Meeting Agenda 19th – 21st: https://indico.bnl.gov/event/17159/
FY23 detector R&D proposals: https://wiki.bnl.gov/conferences/index.php/ProjectRandDFY23
FY22 detector R&D: https://wiki.bnl.gov/conferences/index.php/ProjectRandDFY22

EIC Detector R&D plan:
https://brookhavenlab.sharepoint.com/:b:/s/eRHIC/dac/EbW5yq6lSvhNnWEqTNC-xNEB4hiKMzYW93almUKXdJWlBw?e=t2xa88

Generic EIC-related Detector R&D Program: https://www.jlab.org/research/eic_rd_prgm
Received proposals: https://www.jlab.org/research/eic_rd_prgm/receivedproposals

Appendix B – Meeting Agenda

Wednesday, October 19, 2022

EIC Project Update (9:30 AM - 10:15 AM)
-Presenters: ASCHENAUER, E. C. (BNL); ENT, Rolf (Jefferson Lab)

Update on EPIC (10:15 AM - 11:15 AM)
-Presenter: DALLA TORRE, Silvia (INFN, Trieste)

eRD101 (mRICH) (11:30 AM - 11:50 AM)
-Presenter: SARSOUR, Murad (Georgia State University)

eRD101 - Q&A Session (11:50 AM - 12:00 PM)

eRD102 (dRICH) (12:00 PM - 12:20 PM)
-Presenter: CONTALBRIGO, Marco (INFN Ferrara)
-Presenter: GNANVO, Kondo (Jefferson Lab)

eRD102 - Q&A Session (12:20 PM - 12:30 PM)

eRD108 (MPGDs) (1:00 PM - 1:20 PM)

eRD108 - Q&A Session (1:20 PM - 1:30 PM)

DAC Meeting/Discussion (1:30 PM - 2:30 PM)

Thursday, October 20, 2022

eRD104/eRD111/eRD113 (9:30 AM - 10:00 AM)
-Presenter: GONELLA, Laura (University of Birmingham)

eRD104/eRD111/eRD113 - Q&A Session (10:00 AM - 10:10 AM)

eRD112 (AC-LGAD) (10:10 AM - 10:30 AM)
-Presenter: YE, Zhenyu (University of Illinois at Chicago)

eRD112 - Q&A Session (10:30 AM - 10:40 AM)

eRD103 (hpDIRC) (11:00 AM - 11:20 AM)
-Presenter: KALICY, Grzegorz (CUA)

eRD103 - Q&A Session (11:20 AM - 11:30 AM)

eRD105 (SciGlass) (11:30 AM - 11:50 AM)
-Presenter: HORN, Tanja (Cath)

eRD105 - Q&A Session (11:50 AM - 12:00 PM)

eRD106/eRD107 (12:00 PM - 12:20 PM)
-Presenters: BOCK, Friederike (ORNL); TSAI, Oleg (ucla)

eRD106/eRD107 - Q&A Session (12:20 PM - 12:30 PM)

DAC Meeting/Discussion (12:30 PM - 2:30 PM)

Friday, October 21, 2022

eRD110 (Photosensors) (9:30 AM - 9:50 AM)
-Presenters: KISELEV, Alexander (BNL); PREGHENELLA, Roberto (INFN Bologna)

eRD110 - Q&A Session (9:50 AM - 10:00 AM)

eRD109 (ASICs/Electronics) (10:00 AM - 10:20 AM)
-Presenter: BARBOSA, Fernando (JLab)

eRD109 (Q&A Session) (10:20 AM - 10:30 AM)

DAC Meeting/Close-Out Preparations (10:30 AM - 12:30 PM)

Close-Out (12:30 PM - 1:15 PM)