

Report from Director's Review (as regards SRO)

- This was the third of several important reviews this fall
 - ✓ EIC Project R&D (August 28-31)
 - ✓ DAC Comprehensive Design Review (August 29 – 30)
 - ✓ EIC CD-3A Directors Review (Oct 10 – 12)
 - ☐ EIC CD-3A OPA Review (Nov 14 – 16)
 - ☐ Resource Review Board (Dec 4)
- The CD-3A reviews have a focus on long lead procurements which are the definition of CD-3A, but they are full project reviews! The long lead procurements have to be at the 90% design level, but the full project has to be in position support them, to prove that they are the right procurements, and to be ready to get their jobs done when the time comes.

Plenary
 Building 510, Auditorium
 Day 1
 Tuesday, October 10, 2023
[Click here for Plenary Session](#)

start - finish	Title	Speaker
8:00 AM - 9:00 AM	Full Executive Session (Click for zoom)	S. Cousineau/M. Reichanadter
9:00 AM - 9:05 AM	Welcome	J. Hewett/S. Henderson
9:05 AM - 9:50 AM	Project Overview & CDs Strategy	J. Yeck
9:50 AM - 10:30 AM	Project Management Overview and CD-3A Package	L. Lari
10:30 AM - 10:45 AM	Break	
10:45 AM - 11:15 AM	Technical Design Process & Maturity CD-3A	K. Smith
11:15 AM - 11:45 AM	Performance Baseline Planning for CD-3A	C. Lavelle
11:45 AM - 12:30 PM	Accelerator Status	F. Willeke
12:30 PM - 12:45 PM	Group Photo	All
12:45 PM - 1:30 PM	Lunch	All
1:30PM - 2:00 PM	Detector Status	R. Ent/ E. Aschenauer
2:00 PM - 2:25 PM	Infrastructure Status	C. Polz
2:25 PM - 2:50 PM	Environmental, Safety, and Health	C. Schaefer/W. Rainey
2:50 PM - 3:15 PM	Quality Assurance/Control	C. Porretto/J. Harris
3:15 PM - 3:35 PM	Summary of Plenary & Discussion	J. Yeck
3:35 PM - 3:50 PM	Break	
3:50 PM - 5:30 PM	Breakout Sessions	All
5:30 PM - 6:30 PM	Full Executive Session	S. Cousineau/M. Reichanadter
6:30 PM - 6:40 PM	Travel to Berkner	All
6:40 PM - 8:40 PM	Dinner at Berkner Hall	All

Tuesday, October 10, 2023
 Detector Systems (SC3) Parallel Session
 Building 510, Small Seminar Room
[Click here for SC3 Detector Systems Zoom](#)

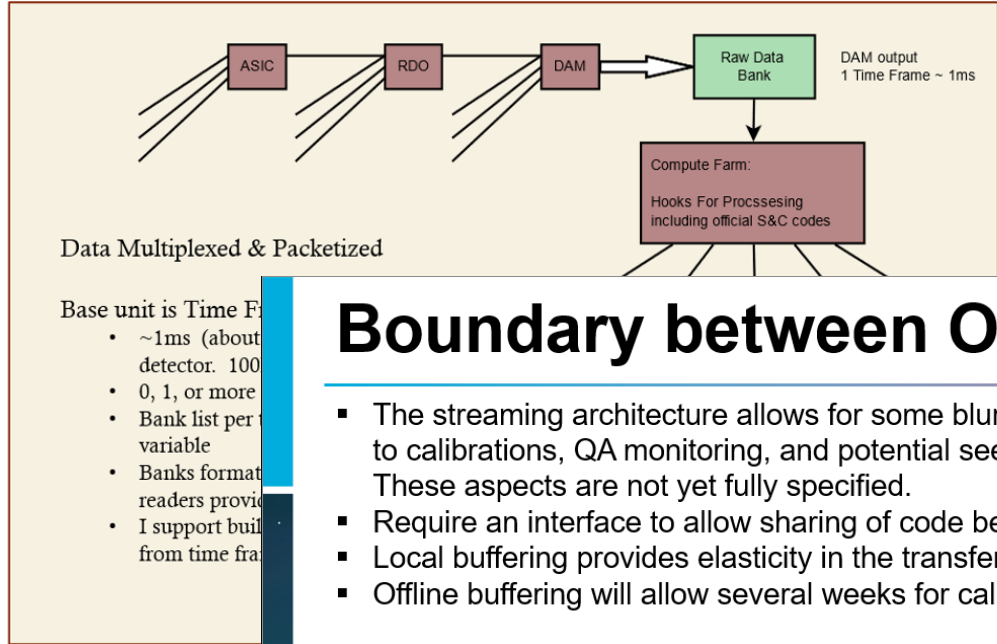
start - finish	Title	Speaker
3:50 PM - 4:30 PM	Detector and ePIC Overview (CD-3a, WBS 6.10.01 & WBS 6.10.02)	R. Ent/ E. Aschenauer
4:30 PM - 4:50 PM	Dector Integration (CD-3a, WBS 6.10.10)	R. Sharma
4:50 PM - 5:20 PM	Q&A/Discussion	

Wednesday, October 11, 2023
 Detector (SC3) Parallel Session
 Building 510, Small Seminar Room
[Click here for SC3 Detector Systems Zoom](#)
[Click here for Subcommittee Executive Session CLOSED](#)

start - finish	Title	Speaker
9:45 AM - 10:05 AM	Detector R&D	T. Ullrich
10:05 AM - 10:25 AM	Tracking	B. Eng
10:25 AM - 10:45 AM	Particle Identification	B. Zihlmann
10:45 AM - 11:10 AM	EM Calorimetry (CD-3a, WBS 6.10.05)	A. Bazilevsky
11:10 AM - 11:35 AM	Hadronic Calorimetry (CD-3a, WBS 6.10.06)	A. Kiselev
11:35 AM - 12:00 PM	Magnet (CD-3a, WBS 6.10.07)	R. Rajput-Ghoshal
12:00 PM - 1:00 PM	Lunch	All
1:00 PM - 1:25 PM	Far-Forward/Far-Backward	Y. Furlitova
1:25 PM - 1:45 PM	Polarimetry	O. Eyser/D. Gaskell
1:45 PM - 2:05 PM	Electronics	F. Barbosa
2:05 PM - 2:25 PM	DAQ/Computing	D. Abbott /J. Landgraf
2:25 PM - 2:40 PM	Break	
2:40 PM - 4:00 PM	Q&A/Discussion	
4:00 PM - 5:00 PM	Subcommittee Executive Session	

DAQ Computing - Streams

- Time Frames (~1ms)
 - Up to ~500 events
 - ~10MB output data
 - ~3.4MB from RDO average / DAM
 - ~100kB to Tape average / DAM
- Routing data
- Formatting data
- Processing data
 - DAM FPGA & CPUs
 - Cluster finding
 - Software triggering
 - Sanity Checkers
 - QA Monitoring
 - Metadata
 - Slow controls integration
- Scalers / continuously running DAQ components



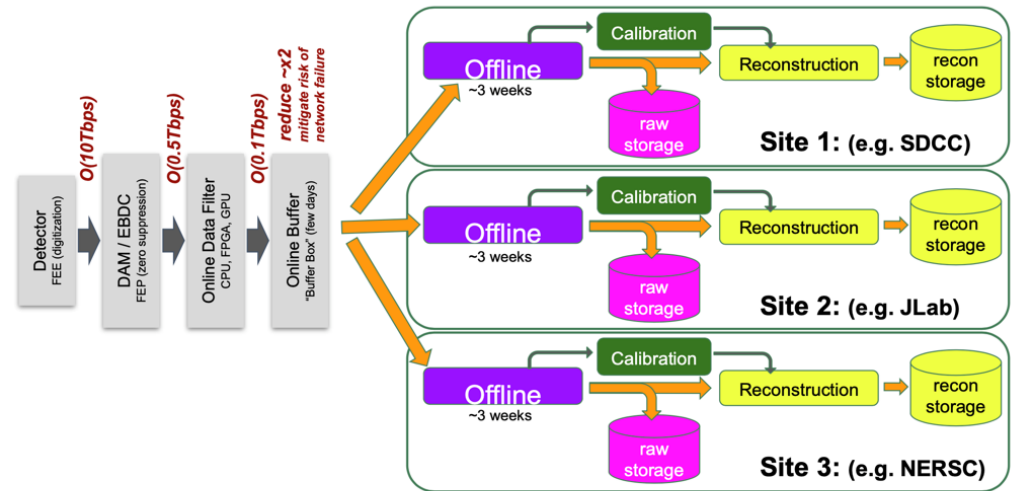
Electron-Ion Collider
EIC CD-3A Director's Review, October 10-12, 2023

Boundary between Online and Offline

- The streaming architecture allows for some blurring of the offline and online processing with respect to calibrations, QA monitoring, and potential seed analysis to improve reconstruction turn around. These aspects are not yet fully specified.
- Require an interface to allow sharing of code between offline / online processing
- Local buffering provides elasticity in the transfer of data to computing facilities
- Offline buffering will allow several weeks for calibration and reconstruction.

ePIC Scientific Computing

- Is a dependency for the project handled in conjunction with host labs.
- The Resource Review Board (RRB) looks at the international detector and computing resources.
- The ePIC computing groups are actively implementing scientific software as well as working with the DAQ to define the interface with the streaming DAQ system.



Electron-Ion Collider
EIC CD-3A Director's Review, October 10-12, 2023

Summary Remarks

The 2015 NSAC Long Range Plan committee recommended the EIC as the next major nuclear physics facility for the US Nuclear physics program, with luminosity up to $10^{34}\text{cm}^{-2}\text{s}^{-1}$ and center of mass energy in the range of 20 - 100 GeV initially, and highly spin polarized electrons, protons, and light ion beams. The EIC will provide unprecedented capability for understanding the interaction of elemental quarks and gluons that form the basic structure of atoms and nuclei.

The committee commends the project team on the outstanding progress on the technical design since CD1. The BNL and JLab teams have the requisite experience and are working very effectively for this stage of the project. A well-focused R&D effort has resulted in converged accelerator and detector designs that provide a firm basis for technical subsystem requirements. The project is on track to deliver a CD2 design by the planned time frame. The committee has confidence in the team's ability to address the remaining technical challenges.

3

General
Committee
Remarks

Overall the committee strongly endorses the CD-3A package and finds that the project is ready to take this step. The CD-3A package is strategically advantageous for the project, particularly with respect to reducing risks associated with supply chain issues and vendor uncertainty. The selected LLPs are appropriate, and with the exception of one LLP which is scheduled for a January FDR, these systems have reached a sufficient level of design maturity for procurement. The scope, cost, and impact of an early procurement are well understood, and the contingency for the CD-3A package is sufficient (~35%).

There is significant potential for improvement in the communication of the CD-3A package to stakeholders, and in particular to the upcoming OPA review committee. Specifically, the technical plenary talks should increase their focus on CD-3A project management aspects (scope, cost, and schedule) in order to demonstrate ownership as the team moves into execution. A concise and compelling argument for the CD-3A package should be made by highlighting the integrated project cost/schedule with and without the 3A package; the same comparison can be made for project risks. The CD-3A breakout presentations would benefit from a greater degree of consistency in format with common project-oriented elements such as scope, cost, schedule, risk, etc. To this end a presentation template is advised.

Following this theme, as the project matures from the R&D/design phase into execution, the team must pivot to a more project-oriented approach to measuring and reporting progress based on tractable quantitative measures. For instance, the readiness for CD2 should be tracked against a firm set of metrics such as % of design reviews completed. All WBS owners should consistently make use of project tools at their disposal when tracking and communicating progress.

While the ESH&Q scope is sufficiently mature for this stage of the project, it currently does not flow down well through the technical presentations. It is important to demonstrate strong and consistent integration between the ESH&Q team and the technical teams. With regard to the upcoming CD3A scope, it would be useful to include ESH&Q considerations for each LLP.

Finally, the committee is concerned that the marginally low project contingency (~31%) combined with the TPC near the top of the CD-1 Cost Range leaves little room for the project to address emergent technical issues that are arising and will likely continue to arise in the future. At the upcoming IPR, the project should be prepared to discuss the plan to define a level of risk-based contingency that would support the baseline.

The project is ready for CD-3A.

SC3 - Detector Systems

Findings:

- The detector group has made progress since CD-1 and a full project management Scientific international (40% US) collaboration ePIC has been organized.

Detector
Committee
Remarks

- Integration and coordination between subcomponents including infrastructure envelope, including services (cooling, power, signal), are being taken into account within project organization.
- EIC detector R&D program is being redefined in view of the recent changes to the design of the detector.
- Tracking detector systems still have many key elements that are not finalized: ITS3 not being available in time, may have significant implications. ITS2 is being considered as back up. Conflict between beampipe baking needs and the tracker system thermal sensitivity is an open issue to be addressed.
- Design of the PID detectors are advancing (TDR stage). In principle, plausible solutions to issues have been identified.
- Solenoid reference design is complete. (LLP item).
- Backward EM calorimeter (PbWO4-part of LLP) design is in reasonable state; PbWO4 is a single supplier item. Barrel EM calorimeter is in two sections; Pb Fiber readout with SiPM and Astropix-based imaging layers which is novel. Forward EM Calorimeter is W/Sci where the fibers are a part of LLP.
- Hadronic calorimeters are sampling scintillator calorimeters. Barrel HCAL is a reused sPHENIX barrel calorimeter. Backward calorimeter repurposes STAR scintillators. The Forward HCAL is a W/Fe-Sc with SiPM readout. The latter is an LLP item.
- There are six far-forward and ancillary detectors planned that will be close to the beamline. The luminosity monitor is planned to be deployed on day 1. The other detectors will be ready but will wait until the beam/background conditions become appropriate for deployment.
- Basic polarimetry methods and detector technologies are established and design is progressing towards CD-2/3.
- EIC is developing a streaming readout architecture. Readout and technology solutions have converged. There is an active hardware and software effort in collaboration with ePIC progressing towards CD-2/3.

Comments:

- The detector group has made impressive progress since CD-1. A rather mature project management for this stage, exists. International detector collaboration ePIC has been established and the project and the collaboration has good coordination.
- The detector integration both within the detector and also with the accelerator is, as usual, a challenge. At this stage of the project, the detector team is addressing these issues in impressive detail.
- Appropriateness of proposed CD-3A LLP items is central to these reviews. While we got the information from separate talks and questions, a sufficiently detailed summary of these items should be up front in the plenary presentation.
- Presenting a summary of policies regarding ESH and Q for detectors (particularly for outside vendor universities, and foreign entities) upfront in the plenary session would alleviate concerns from reviewers in a timely manner.
- There are several possible in-kind contributions that could significantly, and positively impact the project, if successful. One is the NSF proposal which, if approved, will cover the costs of the backwards EM calorimeter including the PbWO4 purchase. There is also a possibility of in-kind contribution for the detector solenoid.

EIC CD-3A Director's Review Committee Report

- Upfront discussion of risks of R&D not coming to a favorable conclusion, and mitigation plans in this case, should be more clearly documented and presented.
- Since Astropix production for the EM calorimeter is probably the largest silicon detector production for EIC, and one of the largest in the field, there should be more detail about its organization, planning and production in the subdetector presentation.
- An overarching concern is the oversight of production yield and the distribution of key parameters for certain components over a large-scale production. These factors will need to be adequately accounted for in the project planning and management before CD-2.
- Based on the presentations made during this review, it remains unclear whether the process of selecting components and transitioning from the research and development phase to production includes the validation of a substantial system prototype for all components. These prototypes for subdetectors should encompass all final components, enabling an assessment of whether these components meet the requirements not only in isolation but also in terms of their integration and overall system performance.
- The magnet LLP is ready to go forward. After CD-3A approval, before the solicitation, the recommendations of the Solenoid Magnet Final Design Review should be implemented.
- The LLP items for the detectors are ready to go forward. Presentation can be improved as described elsewhere in these comments.

Recommendations:

- Quantify (time, cost, performance) and document, before CD-2, mitigation plans for the possibility that some R&D components will not meet expectations.
- Proceed to CD-3A.