

Closeout Report of EIC Computing & Software Review 2024

EIC Computing & Software Advisory Panel

ECSAC Members:

- Frank Wuerthwein (chair), Mohammad Al-Turany, Pere Mato (not present), Verena Martinez Outschoorn, Simone Campana, Christoph Paus

ePIC Representatives:

- John Lajoie, Markus Diefenthaler, Torre Wenaus, Andrea Bressan, Wouter Deconinck, Holly Szumila-Vance

ECSJI Representatives:

- Amber Boehnlein, Alexei Klimentov

Host Lab Representatives:

- H (Associate Laboratory Director for Nuclear and Particle Physics, BNL), David Dean (Deputy Director for Science, Jlab)

Overview

The EIC Computing & Software Advisory Committee (ECSAC) met on September 26 and 27, with ePIC and ECSJI representatives at the Catholic University of America in Washington D.C. Lab Directors joined us for a session via video. ECSAC received a number of excellent presentations, with plenty of time for detailed Q&A. ECSAC provided overnight questions for further clarifications that the ePIC team answered.

We thank the organizers of this review, Amber Boehnlein and Alexei Klimentov for inviting us to hear about this exciting new physics program, for their strong organization of the review, and for their clear instructions and charge. We thank the ePIC representatives and presenters for their time in preparing their material, and their clear presentations. And we thank the ePIC collaboration for supporting the presenters, and their responses to the questions from the Committee.

Overall, we think the ePIC computing & software preparations are in excellent shape for this early in the process. In the following we list the charge questions, and provide for each of them findings, comments, and recommendations.

Charge Question 1: Is there a comprehensive and cost-effective short and long-term plan for the software and computing of the experiment?

- 1. The pre detector technical design report (TDR) is scheduled to be delivered in 2025. Are the resources for software and computing sufficient to deliver the TDR?**
- 2. Is the design of the ePIC computing model and resource needs assessment adequate for this stage of the project?**
- 3. Is the ePIC computing and model flexible? Can it evolve and integrate new technologies in software and computing?**

Findings:

The currently available computing resources are sufficient for the immediate needs of producing a TDR in 2025. Several software developments were made in the last year to support the process. In particular, the software now allows ePIC to build events from time frames.

Since the last ECSAC meeting, the ePIC software and computing team developed a detailed assessment leading to predict the storage and compute needs at the time of first data.

There is no dedicated DOE effort for ePIC software and computing. The available effort is based on synergistic contributions and best effort.

Part of the Echelon 1 responsibilities is to provide near real time processing of frames to events in order to provide feedback to the detector operations on a timescale of seconds to tens of seconds. This is supported via data streaming.

No such near real time processing is envisioned for Echelon 2. "Data streaming" to Echelon 2 sites as part of the scope of the distributed computing model.

A computing model has been presented that is different from the current NHEP experiments to allow for more flexibility. This flexibility aims to foster collaboration in software development and at leveraging opportunities at the facilities for contributing computing services.

Comments:

We congratulate the ePIC collaboration for the achievements made in the last year in terms of software development. We believe that our recommendations from last year's review in that respect were addressed.

It is our impression that the S&C team has a clear plan for where near and long term additional effort would be invested into.

The ePIC collaboration together with the host labs need to develop a long term staffing needs plan for software and computing. Such a plan includes the number of FTE needed each year, and where they are projected to come from. This also includes dedicated ePIC S&C effort from

lab funding that transitions into future S&C project funding. It would be appropriate to scope out an S&C construction project, or a pre-operations project to accomplish this.

The timing for such long term dedicated project funding must be commensurate with the S&C project being in a position to successfully deliver towards the miniDAQ milestone in FY28.

There has been significant progress towards the TDR, showing good readiness of the software and simulation.

We find the discussion of data streaming for Echelon 2 confusing, and do not understand its need. If there are no real time requirements for processing at Echelon 2 sites, we do not understand why the data transfer to Echelon 2 sites can not be supported via traditional methods of file transfer management via Rucio.

The flexibility of the computing model is an important mechanism for engaging partners and leveraging synergies. At the same time it comes with the cost of complexity and that has to be properly balanced. A pragmatic approach streamlining the computing model to support the future baseline needs of ePIC while retaining enough flexibility is advisable.

Recommendations:

Provide a detailed plan and timeline before the next ECSAC meeting for creating dedicated effort to the ePIC S&C team.

Charge Question 2: Are the plans for software and computing consistent and integrated with standard practices across nuclear physics and particle physics communities, especially given technical evolution over the next decade?

Findings:

The software and computing plans are well integrated with standard practices across the nuclear and particle physics communities. The ePIC S&C team use many common tools and are active contributors to several. The S&C principles are designed to take advantage of future developments and be flexible to adapt to new technologies.

Comments:

We congratulate the S&C team for a job well done.

Recommendations:

none

Charge Question 3: Are the ECSJI plans to integrate into the software and computing plans of the experiment sufficient?

Findings:

The role of ECSJI was presented, including details on progress made in co-ordinating ePIC, foreign contributions, the formation of the RRB, among others.

Comments:

Soon there will be a long term decision point for the ECSJI to define whether it wants to be just a body that coordinates resources held in different projects and institutions or alternatively that the ECSJI is the actual organization that owns and manages the future S&C project, including the DOE funding to support the full baseline scope of S&C. In the latter case, one might imagine the ECSJI to also be the body that manages joint funding between DOE and NSF, if the NSF were to engage with the physics program of the EIC.

Recommendations:

none

Charge Question 4: Are the plans for the integrating international partners' contributions flexible and adequate at this stage of the project?**Findings:**

A globally distributed computing model is being developed that is similar to existing global computing efforts. The streaming readout adds requirements for network access, and higher availability and redundancy.

There is an increasing number of international partners in the process of joining the computing and software infrastructure.

Comments:

The streaming readout makes the computing model different from other such models in NHEP.

The international partners appear to be at a healthy and commensurate level with the size of the project at this stage.

It is surprising that there are no US university based DOE or NSF funded plans for Echelon 2 size resources. This is a gap where potential resources and effort could be tapped into.

The comments about tradeoffs between flexibility and complexity earlier in this report is particularly applicable here for the international context

Recommendations:

Investigate how the US universities can contribute to the S&C needs of the experiment, and present a plan at the next ECSAC review.



The image shows five handwritten signatures in black ink, arranged horizontally. From left to right, they appear to be: 'Siame Pitty', 'Verena Martina Ortel', a stylized signature, 'Mr. Paw', and 'Prof. Ortel'.