

# Closeout Report of EIC Computing & Software Review

## EIC Computing & Software Advisory Panel

### **ECSAC Members:**

Frank Wuerthwein (chair), Mohammad Al-Turany, Pere Mato, Heidi Schellmann, David Brown, Simone Campana, Christoph Paus

### **ePIC Representatives:**

Rosi Reed, Sylvester Joosten, Markus Diefenthaler, Torre Wenaus, Andrea Bressan

### **ECSJI Representatives:**

Amber Boehnlein, Eric Lancon

### **Host Lab Representatives:**

Haiyan Gao (Associate Laboratory Director for Nuclear and Particle Physics, BNL)

David Dean (Deputy Director for Science, Jlab)

The EIC Computing & Software Advisory Committee (ECSAC) met on October 19 and 20, with ePIC and ECSJI representatives at the SURA facilities 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 Eric Lancon 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.

### **1. At this stage, approximately ten years prior to data collection, is there a comprehensive and cost-effective long-term plan for the software and computing of the experiment?**

Yes, to the extent that this can be determined at this point.

### **Findings:**

The software and computing for ePIC at the EIC is a complex undertaking with substantial technical and intellectual challenges.

The short term plan has a crucial milestone in the form of the TDR that will require demonstrating the integration of the tracking reconstruction from 'frames' to 'events'. This milestone is set for April 2024. Both the physics for the TDR, and the first ever computing needs assessment depend on this milestone.

**Comments:**

We congratulate the collaboration to have recruited an excellent set of S&C leaders. They have arrived at an impressive organization and plan. While there are substantial challenges ahead, it appears that the collaboration is as well or better prepared and organized as one can expect at this point of time.

**Recommendations:**

We recommend that ECSJI verify the readiness of simulation and reconstruction for the TDR by May 2024.

We recommend that ePIC document a first computing needs assessment by the next ECSAC review, in roughly one year.

**2. Are the plans for integrating international partners' contributions adequate at this stage of the project?**

Yes

**Findings:**

There are clearly very significant opportunities in in-kind computing infrastructure contributions.

Canada, the UK and Italy are engaged as a proof of concept in this context.

**Comments:**

The ePIC collaboration is doing all the right things to make progress towards exploiting in-kind contributions to Computing & Software for ePIC.

**Recommendations:**

No recommendations.

### **3. Are the plans for software and computing integrated with the HEP/NP community developments, especially given data taking in ten years?**

Yes

#### **Findings:**

The ePIC collaboration is planning to use a series of tools and services widely adopted and supported by the NHEP community. These tools and services were adopted successfully by running experiments and for the planning of future projects (e.g. FCC at CERN).

Examples are the data model based on EDM4hep, the detector geometry adopting DD4hep, ACTS for tracking algorithms and generally the packages from Key4HEP software stack. ePIC is contributing to some of the packages, noticeably to DD4hep. Also in the area of distributed computing the current plan is to consider and customize existing solutions, e.g. Rucio for data management.

#### **Comments:**

We support the ePIC strategy to leverage existing solutions in the area of NHEP software and computing and customize them for the experiment needs. It allows reducing effort from the collaboration in developing these tools.

To ensure sustainability, ePIC should consider contributing to the development and support of the key tools. The work done in DD4hep goes in this direction and we encourage ePIC to take the same approach with other tools.

#### **Recommendations:**

We recommend that the ePIC collaboration start by the time of the next year's ECSAC review an evolving list of software dependencies that includes the packages, who the primary supporters are, and what the ePIC collaboration contributes to them.

### **4. Are the resources for software and computing sufficient to deliver the detector conceptual and technical design reports?**

Yes

#### **Findings:**

Current resources for running simulations are 80% from opportunistic sources like the OSG, and only 20% from the Labs.

The host labs have the flexibility to provide more resources if notified in time.

A credible plan for the software development was presented that can achieve the critical TDR milestones.

**Comments:**

The numbers and deliverables associated with the crucial milestones seem well understood.

The ePIC collaboration seems to be on a path towards successfully delivering on the TDR.

Due to the opportunistic nature of the resources, there are uncertainties which could result in a shortfall in time of need.

**Recommendations:**

No recommendations

**5. Are the ECSJI plans to integrate into the software and computing plans of the experiment sufficient?**

Yes

**Findings:**

We were presented with a clear overview of an organization that resembles the LCG/WLCG or US CMS Computing and Software organizations.

The sharing of the responsibilities between ePIC and ECSJI, particularly on the software side, are still being discussed.

**Comments:**

We congratulate the host labs for planning a structure like ECSJI.

It is too early for us to comment on how well this will work long term.

We expect that evaluation and discussions about how well this works in practice will be part of future reviews.

**Recommendations:**

No recommendations.