EIC - Detector Advisory Committee

Report to EIC Resource Review Board
November 2025

Andy White, DAC Chair
(University of Texas at Arlington)

Detector Advisory Committee

Brief history: Formed in 2020 to advise Laboratory and Project Management on EIC Detector R&D and Design

DAC members have expertise in Tracking, Calorimetry, Particle Identification, Electronics, Infrastructure and Mechanics, Data Acquisition and Computing and EIC Science

DAC has general meetings to review detector progress and more focused meetings on R&D on specific topics

Detector Advisory Committee
2025 Members

Edward Kinney	U. Colorado
Ken Wyllie	CERN
Petra Merkel	FNAL
Antonis Papanestis	RAL
Peter Krizan	U. Ljubljana
Ana Machado	U. Campinas, Brazil
Cecillia Gerber	UIC
Brigitte Vachon	McGill U.
Stefano Miscetti	INFN Frascati
Roman Poeschl	IJCLab
Eraldo Oliveri	CERN
Andrew White (Chair)	U. Texas Arlington

10th Meeting of the EIC Detector Advisory Committee
June 11-13, 2025

Charge to DAC

Focus: overall progress and status of the EIC Detector and its projected design maturity readiness for baselining.

Main goal: solicit feedback from the DAC on the maturity status of all detector sub-systems, on remaining significant technical questions, and on integration and maintenance planning and issues.

Charge for 10th DAC Review

1. Is the design of the ePIC detector and its sub-systems appropriate and progressing well?

2. Are the remaining work and technical, cost and schedule risks adequately understood? Are there opportunities?

3. Will the detector be technically ready for baselining by late 2025?

4. Are the detector integration and planning for installation and maintenance progressing well? Are there areas where further ideas should be pursued?

5. Will the detector be ready for start of construction by late 2026?

Charge question #1

Is the design of the ePIC detector and its sub-systems appropriate and progressing well?

YES – but with the following qualifications, comments, and one major concern:

The overall ePIC detector design is well established and well studied with respect to addressing the broad range of the EIC physics program. However, the ePIC design is complex, involving a large number of subsystems many of which feature the first-time use of novel technologies, for which completion of full-scale prototypes and their testing is essential.

TRACKING

For the MAPS/EIC-LAS: *The DAC wishes to stress the critical need for expedient completion of the CERN/DoE agreement for access to the MOSAIX data base. This lack of agreement is a schedule risk to the entire ePIC project.*

SVT the choice of serial powering is attractive but needs quantitative comparison of the change in material versus the extra complexity of serial-powering.

Significant change to the CyMBal, from eight to twelve cylindrical elements being considered - no major physics impact expected - should be verified by simulation to include services, supports and material.

Charge question #1 (cont.)

The design of all aspects of ePIC **Calorimetry** has seen substantial progress with the R&D phase essentially completed.

PID system components designs reviewed (April 2025) with a very positive outcome.

The Far Forward detector components look challenging as does baselining by the end of 2025, while the Far Backward components appear more achievable. The far forward and backward design requires significant discussion and iteration between vacuum, accelerator and detector groups.

The designs of the electron and hadron **polarimeters** are well advanced and have no open questions requiring further design.

The design of all aspects of ePIC **calorimetry** has seen substantial progress with the R&D phase essentially completed.

All **ASICs** have been prototyped at least once, all are progressing successfully.

While there has been good progress in all areas of the ePIC detector, the DAC has some concerns regarding the overall design and implementation of services – installation of cables and cooling services in the limited space available, and the adequacy of cooling to prevent the transfer of a thermal load from one subsystem to another in close proximity and confined spaces.

Charge question #2

Are the remaining work and technical, cost and schedule risks adequately understood? Are there opportunities?

YES – except for some areas of concern as follows:

For the Si-tracking there is a significant program of work remaining: ER2 testing, EIC/ITS3 design, ER3 production testing, EIC-LAS modifications (7 months), ancASIC, submission(s), testing.

The proposed redesign of the CyMBal implies significant additional technical work, affecting production at Saclay (more chambers, more cost) and tests with the SALSA chip. (Re-design now completed – work ongoing on integration)

There is inherent risk in the use of novel MPGD technology for which large-scale prototyping is essential followed by strong focus on QA/QC in production.

For the ancillary detectors integration for B0 and ZDC still looks difficult and for the Roman Pots an escape mechanism should be considered when getting close to the beam.

For the ASICS the DAC recommends to start planning the procurement route as wafer production often requires advance announcement to the foundry so that they can book slots and ensure wafer availability.

Charge question #3

Will the detector be technically ready for baselining by late 2025?

YES – there is generally good progress towards this goal but the DAC notes the following points:

For the SVT there is no viable alternative (ITS2, MPGDs) to ITS3 – so this must be the baseline choice.

For MPGD detectors, defining a list of relevant tests to performed on Test Article Detectors would be beneficial to make a timely identification of critical aspects.

Calorimeter systems will be ready for baselining, except for the nHCAL for which design optimization and simulations are still ongoing and can be delivered later .The DAC recommends to finalize all QA/QC procedures before the start of full component production.

For the ancillary detectors the Far Backward elements should achieve the baselining goal while this will be challenging for the Far Forward detectors (e.g. for B0 complete integration inside the magnet and cooling system).

Some ASICs are well advanced, and prototypes have been used in many of the detector sub-systems.

The ASIC availability is increasingly defining the schedule of finishing the sub-system development. The collaboration has correctly recognized this, The DAC suggests considering the assignment of engineering effort from completed designs be injected to help out with those designs that are lagging behind.

Charge question #4

Are the detector integration and planning for installation and maintenance progressing well? Are there areas where further ideas should be pursued?

YES – in general.

There are many major items listed under the 3I scope. Additional engineering effort may be needed to accomplish all tasks on the schedule foreseen for ePIC completion.

There is a well-defined set of interfaces between subsystems. However, close attention will still be needed to potential areas of mutual interference – for services, thermal loads, emi.

The DAC is concerned by how much SVT could be delayed, and therefore GST assembly, and still keep to the overall assembly/installation schedule?

For the ancillary detectors there are still design/integration issues to be resolved and a start of construction late 2026 is less clear – but these elements are decoupled from the central ePIC detector.

For the ASICs, completion of the PED phase is expected in FY26 and for most of the ASICS production is forecast for FY27 with approximately one year for the fabrication, packaging and testing cycles.

Charge question #5

Will the detector be ready for start of construction by late 2026?

YES for the 2026/2027 timeframe.

Production of well understood/demonstrated subsystems could allow a partial construction start in late 2026.

The completion of necessary work for the Si-SVT for late 2026 construction start depends on 1) the successful sensor testing in ER2, and 2) the timely completion of the agreement with CERN for MOSAIX database access to initiate EIC-LAS design work.

CyMBaL will have a test article in 2026. Preproduction will start in 2027, with full production beginning in 2028. If the new design is adopted, 50% more detectors will need to be produced.

ECT will have a test article by late 2025. Preproduction may start in 2026, with production in 2027. uRWELL BOT assembly starting – early 2026 completion.

The calorimeter subsystems are planning FDRs in 2026 and should be in a good position to start construction by later in 2026.

For the PID systems, the FTOF and BTOF construction readiness depend on ASIC, sensor and mechanical design staying on schedule.

For the ASICs, completion of the PED phase is expected in FY26 and for most of the ASICS production is forecast for FY27 with approximately one year for the fabrication, packaging and testing cycles.

Conclusions

Very significant progress in many areas of the ePIC detector project.

Successfully transitioning from the R&D phase to the PED phase.

Several key areas to monitor closely that can affect successful adherence to the overall schedule and delivering ePIC on time.

Critical need for expedient completion of the CERN/DoE agreement for access to the MOSAIX data base.

Keep up the momentum!