10th DAC meeting/review – close-out insofar related to SVT

- June 11-13, 2025, https://indico.bnl.gov/event/26584/ (has all materials)
- Talks by Joao, Iain, and Ernst on June 12, 2025
- Close-out past Friday; written report will come
- Overall, it seemed to work reasonably well,
- Next are some slides from Andy White's close-out presentation.

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.

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.

For the SVT the choice of serial powering is attractive but has strong implications in not only the EIC-LAS design but also the system design and the planning. The full simulation framework should be used to carry out a more quantitative comparison of the change in material versus the extra complexity of serial-powering.

A significant change to the CyMBal, from eight to twelve cylindrical elements, is being considered due to servicing issues in the assembly hall. A decision is expected soon and while no major physics impact is expected this should be verified by simulation to include all services, supports and material.

Charge question #1 (cont.)

The designs for the PID system components were recently (April 2025) reviewed 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 since detector requirements seem to be less stringent. 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, and further submissions with added features are imminent. Although the designs have different levels of maturity, all are progressing successfully. Some sub-detectors previously had alternative options for readout electronics. These have been resolved and there is a single baseline for each sub-detector.



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.

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 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.

Good progress has been made on mechanics/support mechanisms for the inner and outer barrels and the disks, and a thermo-mechanical half-barrel planned soon – preparing for ER2 sensor in 2026.

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.

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.

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 the CyMBal, testing of the Scale 1 module may be close in time to the expected goal for overall detector baselining. The possible change to the CyMBal layout could factor into the goal for baselining, although the underlying micromegas technology is the same and is well understood. Conversely any move to a new technology for the modules could invoke delay.

For MPGD detectors, defining a list of relevant tests to performed on Test Article Detectors would be beneficial (test beams, full detector irradiation, long term irradiation, tests in magnetic field, ...) 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. However, the nHCAL can be delivered later than the other calorimeter elements (e.g. it is not part of the solenoid flux return). The DAC recommends to finalize all QA/QC procedures before the start of full component production.

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.

Assembly plans shown included all expected detector subsystems; however, attention is needed to the structures/planning that will be required if a delay requires the assembly without certain components, e.g. the SVT or barrel tracker.

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? Meeting the October 2031 installation deadline for the SVT requires design access by Fall 2025.

For the CyMBal the DAC notes that the potential new design implies 50% more detectors and revised integration, installation and maintenance plans. However, the changes should facilitate access and extraction if needed.

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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!

But wait, there is more...

Assessments of baseline readiness for each subproject will measure status and evaluate future work needed to be ready for a DOE CD-2 IPR. The charge for these reviews includes **technical**, **cost**, **schedule**, **and management**. The charge will also evaluate plans to design to cost.

Director's Reviews will be completed by the end of 2025:

Electron Injector Complex - CompleteApril 8-10, 2025Co-Chairs: T. Raubenheimer, SLAC, MAC Chair & E. Peoples-Evans, ANL, APS-U PM.November 12-14, 2025DetectorNovember 12-14, 2025Co-Chairs: A. White, UTA, DAC Chair & S. Nahn, FNAL, USCMS PM.Interaction Region (O. Bruning & R. Carcagno)November 18-20, 2025Co-Chairs: O. Bruning, CERN, HL LHC PM, & R. Carcagno, FNAL retired, HL LHC AUP LHC Deputy PM.December 2025Accelerator Storage RingsDecember 2025Co-Chairs: TBDGlobal Project and Energy & Luminosity Ramp-up (TBD)December 2025

But wait, there is more...

- The November 12-14 review is even more of a readiness review,
- This will entail a considerable amount of effort for SVT,
- pPDR and 10th DAC recommendations will obviously need to be addressed,
- Note that we need to do this well before the dates of the actual review,
- We can do it.