

# TIC meeting

September 25, 2023

## Feedback from DAC comprehensive detector review

- August 29 + 30: **DOE CD-3A Design Review by DAC**

Highlight of the messages (from the close-out slides) here grouped by subsystem taking them from both reviews

# REMINDER: the comprehensive review charge

- 1) Given the detector progress over the last two years and the status of the ePIC detector, **are the projected timelines of the Electron-Ion Collider detector feasible?** Do there **remain significant open detector technology questions?**
- 2) Are the **requirements for the detector and their flow down sufficiently comprehensive** for this stage of the project to complete the design of the various detector technologies?
- 3) Are the **interfaces between the elements of the design adequately defined** for this stage of the project and to proceed with the detector long-lead procurement items?
- 4) **Is the design of these long-lead procurement items sufficiently advanced** and mature to start procurement in 2024? Are the technical specifications complete?
- 5) Is the projected **design maturity of the further detector components** likely to be accomplished by the end of 2024 for CD-2 and CD-3?
- 6) Is the **overall schedule** for completion of the design, production, and installation of detector components **realistic?**

- **Amazing progress** in the last two years
- Design of the **detector integration and installation are developing well**; the interaction of project engineering staff with detector groups appeared excellent
- Projected **timelines** are aggressive, but appear feasible
  - *Primary risk in delays of*
    - *Magnet*
    - *Si tracker*
  - *Also iterated in the report : “The magnet and SVT remain high risk items”*
- **All central detector technologies have been chosen and appear appropriate.**
- Several technologies still **require significant further R&D, prototyping/production cycles** in order to confirm that they will provide the required performance
  - (also with reference to test beam difficulties in the next years)
  - *Silicon Tracker*
  - *$\mu$ RWELL tracker*
  - *Imaging Sci/Fi tracking calorimeter*
  - *AC-LGAD Tracker*
  - *pfRICH prototype*
- **less advanced systems**, which we nonetheless feel can be ready for CD2/3 are:
  - *the electron polarimeters*
  - *the dual RICH*
  - *the far forward and backward detectors*
  - *the TOF detectors.*

Warnings for EPIC

- There **remains concern** that **radiation hardness and background rate** issues may still affect detector performance (and design), with time-dependent rate and noise dependences. We urge the incorporation of the machine background expectations into the detector simulations as well as attempting to provide conservatively large safety margins.
- **Component failure rate requirements incorporated in evaluation of performance** would be useful for evaluating detector technology
- A comprehensive description of the **survey/alignment/monitoring and calibration strategy** for the hardware components of all detector systems is needed.
- Many of the components are already in advanced stages of design, nearly ready for a CD2/3 review (a part what already mentioned concerning design and R&d/prortotyping)
- The **overall schedule appears realistic given that the schedule does not have added contingency**, and in many cases is based on actual experience at RHIC and Jlab. It is nonetheless quite aggressive and ambitious, and will require careful monitoring of critical milestones.
- **Development of contingency plans** would be useful for understanding the effects of delays which occur in the schedule. Flexibility in the schedule should be maintained as much as possible to minimize risk to the project.

- **Magnet**
  - The magnet design is nearly completed and seemed ready to advance to procurement within a few months. The specifications are clear and the design appears quite mature, with good cooling system redundancy.
- **SiPMs for use in the PID/CAL detectors**
  - the background conditions are varied within the detector so that close attention to the specifications are needed
  - A summary of the different types of SiPM being planned for long procurement would be useful for evaluating whether they are optimal in pixel size and environmental sensitivity [*such a table then presented at SiPM review*]
- **PbWO4 crystals for the electron endcap calorimeter**
- **scintillating fibers for the calorimeters**
- **the absorber (W and steel) for the forward HCAL/insert**
  - Design of the forward HCALs is quite advanced

Warnings  
for EPIC

Recall: magnet delay indicated as one of the primary risks

- The final magnet review should be carried out expeditiously to mitigate any delay. [recall: Final Design Review of Magnet on Oct. 5-6]
- The progress of the magnet from procurement to delivery should be closely monitored.
- In the event of delay what is planned to occur or how will the present plan change? [an open question ...]
- Magnet correctly identified in LLP items
  - The magnet design is nearly completed and seemed ready to advance to procurement within a few months. The **specifications are clear and the design appears quite mature**, with good cooling system redundancy.

# Si trackers

Recall (from general comments):

Si Tracker delay indicated as one of the primary risks

Significant further R&D needed to prove performance as requested

Prototype/production cycles needed

- The silicon tracker development is tied to the ITS3/ALICE development, and continues past CD2/3
- The silicon tracker development will also require close attention.
- in the event of serious issues with the 65nm yields what will be the consequences and planning for the SVT



- $\mu$ RWELL tracker still require significant R&D
- The  $\mu$ RWELL endcap/barrel tracker prototype needs validation with beam test (difficulties in getting test beam slots)

- require **significant further R&D** in order to confirm the required performance
- prototype needs validation with **beam test**
- The recent choice of the imaging calorimeter technology made this **design less mature**; however, as it is based on the existing GLUE-X calorimeter, the long lead purchase of the scintillating fiber and SiPMs are specified sufficiently well.
- It was not mentioned **how long** it would take to **procure** sufficient **astropix** detectors and **what services/conditions they require** for reliable operation.

- Less advanced **design**
- The **cooling infrastructure for the SiPM** needs some further study, as unforeseen issues could impact the interface to nearby detector systems

- prototype needs validation with beam test

- Requiring significant further R&D
- Requiring prototyping and beam tests
- Less advanced design

- ASIC development should be closely monitored as it has often taken significantly more time and effort than originally planned
- The development of the various ASICs continues past CD2/3

# From my analysis of the closeout messages

- All the items indicated by DAC as deserving particular attention are correctly identified
- Nevertheless, I would say that there are other critical aspects not mentioned, but relevant for ePIC success
- The planning of TIC activity will make good use of the indications received; this is already the case with the agenda of the next three meetings that have been announced